Safety Evaluation Report

Related to the License Renewal of Fermi 2

Docket No. 50-341

DTE Electric Company

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

July 2016

ABSTRACT

This safety evaluation report (SER) documents the technical review of the Fermi 2 Nuclear Power Plant (Fermi 2) license renewal application (LRA) by the U.S. Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated April 24, 2014, DTE Electric Company (DTE or the applicant) submitted the LRA 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). DTE requests renewal of the Fermi 2 operating license (Operating License No. NPF-43) for a period of 20 years beyond the current expiration at midnight on March 20, 2025.

Fermi 2 is located on the western shore of Lake Erie at Lagoona Beach, Frenchtown Township, in Monroe County, Michigan. The NRC issued the operating license on March 20, 1985. Fermi 2 is a single-cycle, forced-circulation boiling water reactor (GE-BWR 4). General Electric Company (GE) furnished the nuclear steam supply system. Fermi 2’s licensed power output is 3,486 megawatts thermal with a turbine-generator net electrical output of approximately 1,170 megawatts electric.

The decommissioned Enrico Fermi Atomic Power Plant (Fermi 1) is within the Fermi 2 Owner Controlled Area. Fermi 1 (Operating License No. DPR-9) was a sodium-cooled fast breeder reactor. It is permanently shut down, in SAFSTOR status. The nuclear fuel has been shipped offsite.

This SER presents the status of the staff’s review of information submitted through May 30, 2016. The one open item identified in the SER with open items, issued January 28, 2016, has been closed (see Section 1.5); therefore, no open items remain to be resolved. On the basis of its 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

AAI	applicant action item
AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
AERM	aging effect requiring management
AFW	auxiliary feedwater
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
APCSB	Auxiliary Power Conversion System Branch
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
BDBEE	beyond design basis external events
BTP	Branch Technical Position
BWR	boiling water reactor
°C	degrees Celsius
CARD	Condition Assessment Resolution Document
CASS	cast austenitic stainless steel
CBF	cycle-based fatigue
CCHVAC	Control Center heating, ventilation, and air conditioning
CE	Combustion Engineering Company
CECO	Central Component (database)
CFR	*Code of Federal Regulations*
CLB	current licensing basis
CO_2	carbon dioxide
CRD	control rod drive
CRT	condensate return tank
CST	condensate storage tank
CTG	combustion turbine generator
Cu	copper
CUF	cumulative usage factor
CUF_{en}	environmentally assisted fatigue cumulative usage factor
DBA	design basis accident
DBE	design basis event
DC	direct current
DG	diesel generator
DO	dissolved oxygen
DTE	DTE Electric Company
EAF	environmentally assisted fatigue
ECCS	emergency core cooling system
EDG	emergency diesel generator

EDGSW	emergency diesel generator service water
EECW	emergency equipment cooling water
EESW	emergency equipment service water
EFPY	effective full-power year
EPRI	Electric Power Research Institute
EPU	extended power uprate
EQ	environmental qualification
ESF	engineered safety features
°F	degrees Fahrenheit
F_{en}	environmentally assisted fatigue correction factor
FERC	Federal Energy Regulatory Commission
Fermi 2	Fermi 2 Nuclear Power Plant
FOST	fuel oil storage tank
FPCCS	fuel pool cooling and cleanup system
FPEE	fire protection engineering evaluation
FR	*Federal Register*
FSAR	final safety analysis report
FSER	final safety evaluation report
ft	foot (feet)
ft-lb	foot-pound
FW	feedwater
GALL	Generic Aging Lessons Learned (Report)
GE	General Electric Company
GEH	General Electric-Hitachi
GEIS	Generic Environmental Impact Statement
GL	generic letter
gpm	gallons per minute
GSI	generic safety issue
GSW	general service water
HELB	high-energy line break
HPCI	high-pressure coolant injection
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and controls
I&E	inspection and evaluation
I&FE	inspection and flaw evaluation
IASCC	irradiation-assisted stress corrosion cracking
ID	inside diameter
IER	Institute of Nuclear Power Operations Event Report
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leak rate testing
IN	information notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
ISP	integrated surveillance program

ksi	kilopound per square inch
KV or kV	kilovolt
lb	pound(s)
LBB	leak-before-break
LCO	limiting condition of operation(s)
LLRT	local leakage rate testing
LOCA	loss-of-coolant accident
LPCI	low-pressure coolant injection
LRA	license renewal application
LR-ISG	license renewal interim staff guidance
LTOP	low-temperature overpressure protection
$\mu g/cm^2$	micrograms per centimeter squared
MC	metal containment
MDCT	mechanical draft cooling tower
MEB	metal enclosed bus
MeV	million electron volt(s)
MoS_2	molybdenum disulfide
mpy	mil(s) per year
MSIV	main steam isolation valve
MUR	measurement uncertainty recapture
MUR/TPO	measurement uncertainty recapture/thermal power optimization
mV	millivolt
MWe	megawatts electric
MWt	megawatts thermal
n/cm^2	neutrons per square centimeter
NACE	National Association of Corrosion Engineers
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
Ni	nickel
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
O_2	oxygen
OBE	operating-basis earthquake
ODSCC	outside-diameter stress corrosion cracking
PCAC	primary containment atmosphere cooling
PCM	primary containment monitoring
PCP	primary containment pneumatics
pH	potential of hydrogen
PM	preventative maintenance
PORV	power-operated relief valve
ppm	parts per million
psi	pounds per square inch
psig	pound(s) per square inch gauge
PSPM	Periodic Surveillance and Preventive Maintenance
P-T	pressure-temperature

PTLR	pressure-temperature limits report
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
radwaste	radioactive waste
RAI	request for additional information
RBCCW	reactor building closed cooling water
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal
RHRSW	residual heat removal service water
RPV	reactor pressure vessel
RT_{NDT}	reference temperature nil ductility transition
RVI	reactor vessel internal
RWCU	reactor water cleanup
S_A	stress allowables
SBA	small break accident
SBO	station blackout
SBF	stress-based fatigue
SC	structure and component
SCC	stress corrosion cracking
scfh	standard cubic feet per hour
SE	safety evaluation
SER	safety evaluation report
SC	structure and component
SGTS	standby gas treatment system
SLC	standby liquid control
SLC/core ΔP	standby liquid control system/core ΔP
S-N	stress-number
S&PC	steam and power conversion
SRP	Standard Review Plan
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SRV	safety relief value
SSC	system, structure, and component
SSE	safe-shutdown earthquake
TIP	traversing incore probe
TLAA	time-limited aging analysis
TR	Technical Report
TRM	Technical Requirements Manual
TS	Technical Specification(s)

UFSAR	updated final safety analysis report
USE	upper-shelf energy
UT	ultrasonic testing
UUSE	unirradiated upper-shelf energy
UV	ultraviolet
V	volt(s)
VAC	volts alternating current
VDC	volts direct current
yr	year
Zn	zinc
1/4 T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Fermi 2 Nuclear Power Plant (Fermi 2) as filed by DTE Electric Company (DTE, or the applicant). By letter dated April 24, 2014, DTE submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the Fermi 2 operating license for an additional 20 years. The NRC staff (the staff) prepared this report to summarize the results of its safety review of the LRA for compliance with Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 54). The NRC project managers for the license renewal review are Ms. Daneira Meléndez-Colón and Ms. Lois James. Ms. Meléndez-Colón may be contacted by telephone at 301-415-3301 or by electronic mail at Daneira.Melendez-Colon@nrc.gov. Ms. James may be contacted by telephone at 301-415-3306 or by electronic mail at Lois.James@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of License Renewal
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Daneira Meléndez-Colón, Mail Stop O11-F1
Lois James, Mail Stop O11-F1

In its April 24, 2014, submission letter, as amended, the applicant requested renewal of the operating license issued under Section 103 (Operating License No. NPF-43) of the Atomic Energy Act of 1954, as amended, for Fermi 2 for a period of 20 years beyond the current expiration at midnight on March 20, 2025. Fermi 2 is located on the western shore of Lake Erie at Lagoona Beach, Frenchtown Township, in Monroe County, Michigan. The NRC issued the operating license on March 20, 1985. Fermi 2 is a single-cycle, forced-circulation boiling water reactor (GE-BWR 4). General Electric Company (GE) furnished the nuclear steam supply system. Fermi 2's licensed power output is 3,486 megawatts thermal with a turbine-generator net electrical output of approximately 1,170 megawatts electric. 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 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 Fermi 2 license renewal is based on the applicant's LRA and responses to the staff's requests for additional information (RAIs). The applicant supplemented the LRA and provided clarifications through its responses to the staff's RAIs in audits, meetings, and docketed correspondence. The staff reviewed and considered information submitted through May 30, 2016. The public may view the LRA and all pertinent information and materials, including the UFSAR, at the NRC Public Document Room located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, MD 20852-2738 (301-415-4737/800-397-4209), and at the Ellis Library and Reference Center, 3700 South Custer Road, Monroe, MI 48161. 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 safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the unit's proposed operation for an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 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)" ("Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplement 56 Regarding Fermi 2 Nuclear Power Plant," issued October 27, 2015). This supplement discusses the environmental considerations for license renewal for Fermi 2. The final, plant-specific GEIS Supplement 56 is scheduled to be issued in 2016.

1.2 License Renewal Background

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

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

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

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

1.2.1 Safety Review

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

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

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

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

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

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

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

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

In the LRA, the applicant stated that it used the process defined in NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010. The GALL Report summarizes staff-approved aging management programs (AMPs) for many SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for LRA review can be greatly reduced, improving the efficiency and effectiveness of the license renewal review process. The GALL Report summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the SCs used throughout the industry. The report is also a quick reference for both applicants and staff reviewers to AMPs and activities that can manage aging adequately during the period of extended operation.

1.2.2 Environmental Review

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

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

In accordance with the National Environmental Policy Act of 1969 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 July 24, 2014, at the Monroe County Community College, in Monroe, Michigan, to identify plant-specific environmental issues. The draft, plant-specific GEIS

Supplement 56 documents the results of the environmental review and makes a preliminary recommendation on the license renewal action. The staff held another public meeting on December 2, 2015, at the Monroe County Community College in Monroe, Michigan, to discuss the draft, plant-specific GEIS Supplement 56. After considering comments on the draft, the staff will publish the final, plant-specific GEIS Supplement 56 separately from this report.

1.3 Principal Review Matters

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

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

In accordance with 10 CFR 54.19(b), the NRC requires that the LRA include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, 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." Item 3 of the Attachment to the current indemnity agreement (No. B-20) for Fermi 2, as revised by Amendment No. 27, lists Fermi 2 facility operating license number NPF-43 with no expiration date for the license. 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, DTE 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 number upon issuance of the renewed license, if approved. Therefore, conforming changes to the indemnity agreement need not be made and the 10 CFR 54.19(b) requirements have been met.

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

In accordance with 10 CFR 54.21(b), the NRC requires that, each year following submission of the LRA and at least 3 months before the scheduled completion of the staff's review, the applicant submit an LRA amendment identifying any CLB changes to the facility that affect the contents of the LRA, including the UFSAR supplement. By letter dated May 9, 2016, the applicant submitted an LRA update that summarizes the CLB changes that have occurred during the staff's review of the LRA. This submission 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) that are necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that it had not identified any TS changes necessary for issuance of the renewed Fermi 2 operating license. This statement adequately addresses the 10 CFR 54.22 requirement.

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

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

1.4 Interim Staff Guidance

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

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

Table 1.4-1 Current Interim Staff Guidance

ISG Issue (Approved ISG Number)	Purpose	SER Section
"Aging Management of Stainless Steel Structures and Components in Treated Borated Water," Revision 1 (LR-ISG-2011-01)	This LR-ISG clarifies the staff's existing position on aging management in treated borated water environments.	Not applicable for the SER
"Aging Management Program for Steam Generators" (LR-ISG-2011-02)	This LR-ISG evaluates the suitability of using Revision 3 of NEI 97-06 for implementing the licensee's steam generator aging management program.	Not applicable to BWRs
"Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 AMP XI.M41, 'Buried and Underground Piping and Tanks'" (LR-ISG-2011-03)	This LR-ISG gives additional guidance on managing the effects of aging on buried and underground piping and tanks.	SER Sections 3.0.3.1.2 and 3.0.3.2.7

ISG Issue (Approved ISG Number)	Purpose	SER Section
"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 internal components during the term of a renewed operating license.	Not applicable to BWRs
"Ongoing Review of Operating Experience" (LR-ISG-2011-05)	This LR-ISG clarifies the staff's existing position in the SRP-LR that acceptable license renewal AMPs should be informed and enhanced when necessary, based on the ongoing review of both plant-specific and industry operating experience.	SER Section 3.0.5.2
"Wall Thinning Due to Erosion Mechanisms" (LR-ISG-2012-01)	This LR-ISG gives additional guidance on managing the effects of wall thinning due to erosion mechanisms.	SER Section 3.0.3.2.11
"Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation" (LR-ISG-2012-02)	This LR-ISG gives guidance on managing the effects of aging for internal surfaces, fire water system, atmospheric storage tanks, and corrosion under insulation.	SER Sections 3.0.3.1.1, 3.0.3.1.11, 3.0.3.2.7, 3.0.3.2.10, 3.0.3.3.1, 3.3.2.1.14, and 3.3.2.3.3
"Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" (LR-ISG-2013-01)	This LR-ISG gives guidance on aging management for coating or lining integrity for internal coatings/linings on in-scope piping, piping components, heat exchangers, and tanks.	SER Sections 3.0.3.2.24, 3.2.2.3.2, 3.3.2.1.1, 3.3.2.3.3, and 3.4.2.3.3
"Changes to Buried and Underground Piping and Tank Recommendations" (LR-ISG-2015-01)	This LR-ISG replaces GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," and the associated final safety analysis report summary description. The LR-ISG provides revised guidance on managing aging effects associated with buried and underground piping and tanks.	SER Section 3.0.3.1.2

1.5 Summary of Open Items

As a result of its review of the LRA, including additional information submitted through May 30, 2016, the staff closed the following open item previously identified in the "Safety Evaluation Report with Open Items Related to the License Renewal of Fermi 2," dated January 28, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16020A440). No other open items remain to be addressed. An item is considered open if, in the staff's judgment, it does not meet all applicable regulatory requirements at the time of the issuance of this SER. A summary of the basis for the open item closure is presented here.

Open Item 4.3.3-1 Effects of Reactor Water Environment on Fatigue Life

By letter dated September 24, 2015, the applicant provided its response to RAI 4.3.3-3. In this letter, the applicant stated that there are locations where the environmentally assisted fatigue (EAF) correction factors (F_{en}) were recalculated using average transient temperatures or maximum operating temperatures. The RAI 4.3.3-3 response also states that these F_{en} factors were recalculated in a manner consistent with NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials."

The staff and applicant held a telephone conference call on December 15, 2015, to discuss and clarify the applicant's response to RAI 4.3.3-3. Specifically, the topic of the telephone conference was to clarify the manner in which the average temperatures were calculated to confirm consistency with NUREG/CR-6909. During the telephone conference call, the applicant described the methods used to calculate average temperatures. Based on these descriptions, the staff determined that the applicant's average temperature calculations were not always consistent with the guidance in NUREG/CR-6909 when the minimum temperature is below the temperature threshold for a given material. This may result in the underestimation of both the F_{en} factors and the resulting EAF cumulative usage factors (CUF_{en}) for some locations. A summary of the telephone conference is provided in the NRC's letter dated January 8, 2016 (ADAMS Accession No. ML16005A399). By letter dated January 14, 2016, the staff issued RAI 4.3.3-3a requesting that the applicant assess the impact of revising the evaluations to use the correct determination of average temperature in a manner consistent with NUREG/CR-6909 and submit a description of the impact of this revision to the previous screening and F_{en} evaluation results for staff review. The staff stated that the assessment should include a description of whether the revised average temperature calculations impact the selection of sentinel locations.

By letter dated March 10, 2016, the applicant provided its response to RAI 4.3.3-3a. The NRC staff finds that the applicant has demonstrated that, pursuant to 10 CFR 54.21(c)(1)(iii), the effects of environmentally assisted fatigue due to the reactor water environment on the intended functions of the American Society of Mechanical Engineers (ASME) Class 1 reactor pressure vessel boundary will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.3 because the applicant has addressed the staff recommendation for the closure of GSI-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life." The applicant has identified high-fatigue usage locations, including those in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," and has evaluated these locations using the formulas, fatigue curves, and guidance in NUREG/CR-6909. The applicant is managing the effects of cumulative fatigue damage on the intended functions of the applicable components using the Fatigue Monitoring Program. The staff's review of the Fatigue Monitoring Program appears in SER Section 3.0.3.2.8. Open Item 4.3.3-1 is closed.

1.6 Summary of Confirmatory Items

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

1.7 <u>Summary of Proposed License Conditions</u>

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

License Condition No. 1:

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

License Condition No. 2:

The License Renewal UFSAR Supplement, as updated by license condition [1] above, describes certain programs to be implemented and activities to be completed before the period of extended operation, as follows:

(a) The applicant shall implement those new programs and enhancements to existing programs no later than 6 months prior to the period of extended operation [PEO].

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

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.

License Condition No. 3:

DTE shall fully implement the Boraflex rack replacement approved in Amendment No. 141 before the period of extended operation (i.e., March 20, 2025), so that the Boraflex material in the spent fuel pool will not be required to perform a neutron absorption function. DTE shall submit a letter to the NRC, within 60 days following completion of the removal of the Boraflex material and installation of the Boral material, as described in Amendment No. 141, confirming the removal of the Boraflex material and discontinued reliance on its neutron absorption function.

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 structures, systems, 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:

- Part 54 of 10 CFR, "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 DTE Electric Company (DTE or the applicant) to identify the SSCs at Fermi 2 within the scope of license renewal (scoping) and the SCs subject to an AMR (screening).

2.1.3 Scoping and Screening Program Review

The U.S. Nuclear Regulatory Commission (NRC or the staff) evaluated the applicant's scoping and screening methodology in accordance with the guidance 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 that the staff used to assess the adequacy of the scoping and screening methodology 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 used by the applicant 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 10 CFR 54.4(a) and for identifying SCs that are subject to an AMR in accordance with 10 CFR 54.21(a).

In addition, the staff conducted a scoping and screening methodology audit at the Fermi 2 facility located in Monroe County, Michigan, during the week of August 4-7, 2014. 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 with 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 used by the applicant during the LRA development, and the training of the applicant's staff that participated in the LRA development.

On a sampling basis, the staff performed a review of scoping and screening results reports and supporting current licensing basis (CLB) information for portions of the emergency equipment service water (EESW) system and residual heat removal (RHR) complex support equipment and corresponding structures. In addition, the staff performed walkdowns of selected portions of those systems and structures as a part of the sampling review of the implementation of the applicant's 10 CFR 54.4(a)(2) scoping methodology.

2.1.3.1 Implementation 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 in 10 CFR 54.4, "Scope" and 10 CFR 54.21.

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

- Fermi 2 Central Component (CECO) database
- updated final safety analysis report (UFSAR)
- maintenance rule basis documents
- design basis documents
- fire hazards analysis
- safe shutdown analysis
- station drawings

2.1.3.1.2 Staff Evaluation

Scoping and Screening Implementation Procedures. The staff reviewed the applicant's scoping and screening methodology implementing procedures, including license renewal guidelines, documents, and reports, as documented in the staff's audit report, to ensure that 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," Revision 1, dated September 2005, which endorses the use of NEI 95-10. The staff determined that the overall process used to implement the 10 CFR Part 54 requirements described in the implementing procedures, including license renewal guidelines, documents, and reports, is consistent with the Rule, the SRP-LR, and the endorsed industry guidance.

The applicant's implementing procedures contain guidance for determining plant SSCs within the scope of the Rule and for determining 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 in the LRA, including the implementation of the staff's positions documented in the SRP-LR, and with information in the applicant's responses, dated November 18, 2014, to the staff's requests for additional information (RAIs), dated October 20, 2014. After reviewing the LRA and supporting documentation, the staff determined that the scoping and screening methodology instructions are consistent with the methodology description provided in LRA Section 2.1. The staff also determined that the methodology is sufficiently detailed in the implementing procedures to provide concise guidance on the scoping and screening process to be followed during the LRA activities.

Sources of Current Licensing Basis Information. The regulation at 10 CFR Part 54.21(a)(3) requires, for each SC determined to be subject to an AMR, the applicant to demonstrate that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation. The regulation at 10 CFR Part 54.3(a) defines the CLB, in part, as the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design bases that are docketed and in effect. The CLB includes applicable NRC regulations, orders, license conditions, exemptions, technical specifications, and design basis information (documented in the most recent UFSAR). The CLB also includes licensee commitments remaining in effect that were made in docketed licensing correspondence, such as licensee responses to NRC bulletins, generic letters, and enforcement actions, and licensee commitments documented in NRC safety evaluations or licensee event reports. The staff considered the scope and depth of the applicant's CLB review to verify that the methodology is sufficiently comprehensive to identify SSCs within the scope of license renewal and as SCs that are subject to an AMR.

During the scoping and screening methodology audit, the staff confirmed that the applicant's detailed license renewal program guidelines specified the use of the CLB source information in developing scoping evaluations. The staff reviewed pertinent information sources used by the applicant including the Fermi 2 CECO database, the UFSAR, maintenance rule basis documents, design basis documents, fire hazards analysis, safe shutdown analysis, and station drawings.

During the audit, the staff discussed the applicant's administrative controls for the CECO 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 on 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; therefore, the staff determined that the information sources used by the applicant during the scoping and screening process provided a controlled source of system and component data to support scoping and screening evaluations.

In addition, the staff reviewed the implementing procedures and results reports used to support identification of SSCs that the applicant relied on to demonstrate compliance with the requirements of 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a listing of documents used to support scoping evaluations. The staff determined that the design documentation sources, 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, 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 License Renewal Application Development

2.1.3.2.1 Staff Evaluation

The staff reviewed the quality controls used by the applicant to ensure that the scoping and screening methodology used to develop the LRA were adequate for the activity. The applicant used the following quality control processes during the LRA development:

- The license renewal team coordinated and reviewed all license renewal activities.
- Subject matter experts, supervisors, and managers prepared and reviewed basis documents, reports, and the LRA.
- The nuclear quality assurance organization performed a surveillance of LRA development activities.
- Industry peers reviewed the draft LRA.
- The onsite safety review organization and nuclear safety review group reviewed the LRA.

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

2.1.3.2.2 Conclusion

Based on its review of pertinent LRA development guidance and review of the applicant's documentation of the activities performed to assess the quality of the LRA, the staff concludes that the applicant's quality assurance activities are adequate to ensure that LRA development activities were performed in accordance with the applicant's license renewal program requirements.

2.1.3.3 Training

2.1.3.3.1 Staff Evaluation

The staff reviewed the training process used by the applicant for license renewal project personnel to confirm that it was appropriate for the activity. As specified by the license renewal implementing procedures, the applicant has required training and qualification of personnel performing activities supporting the development of the LRA, including identification of SSCs within the scope of license renewal, identification of SCs subject to an AMR, and documentation of the information in reports.

Training included the following topics and activities:

- Fermi 2 License Renewal Project Plan
- license renewal overview
- operating experience review
- industry guidelines for implementation of 10 CFR Part 54
- NRC SRP-LR
- NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report"
- system and structure scoping
- mechanical system screening and AMR
- structural screening and AMR
- electrical system screening and AMR
- evaluation of aging management programs (AMPs)
- time-limited aging analyses and exemptions evaluation
- LRA development

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 determines that the applicant has 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 has developed and implemented adequate procedures to train personnel to implement the scoping and screening methodology described in its implementing procedures and the LRA.

2.1.3.4 Conclusion of Scoping and Screening Program Review

Based on its review of information provided in LRA Sections 2.0 and 2.1, 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 describes the applicant's methodology used to identify SSCs within the scope of license renewal pursuant to the criteria in 10 CFR 54.4(a). The LRA states that the scoping process identified the SSCs that (1) are safety related, (2) perform and support an intended function for responding to a design basis event (DBE), (3) are nonsafety related whose failure could prevent accomplishment of a safety-related function, or (4) 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 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 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 50.49(b)(1). Design basis events are defined in 10 CFR 50.49(b)(1) 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). A Fermi 2 engineering procedure provides the criteria and methodology for determining and evaluating the safety and quality classification of systems, structures, and components.

2.1.4.1.2 Staff Evaluation

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

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

> The set of design basis events as defined in the rule is not limited to Chapter 15 (or equivalent) of the UFSAR. Examples of design basis events that may not be described in this chapter include external events, such as floods, storms, earthquakes, tornadoes, or hurricanes, and internal events, such as a high energy line break. Information regarding design basis events as defined in 10 CFR 50.49(b)(1) may be found in any chapter of the facility UFSAR, the Commission's regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify systems, structures, and components that are relied 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 Fermi 2. 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 UFSAR 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 has 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 reports of the scoping results to ensure that the applicant applied the methodology in accordance with the implementing procedures. In addition, the staff discussed the methodology and results with the applicant's personnel who were responsible for these evaluations.

The staff reviewed the applicant's evaluation of the Rule and CLB definitions pertaining to 10 CFR 54.4(a)(1). The staff noted the applicant's CLB definition of safety related met the definition of safety related as specified in the Rule with the exception that it did not include a reference to the 10 CFR 50.67(b)(2) alternate source term related to potential offsite exposure criteria. The staff reviewed LRA Section 2.1.1, "Scoping Methodology," which states that the applicant had reviewed the applicability of 10 CFR 50.67, "Accident Source Term," and determined that the applicant had credited the use of alternate source term in the fuel-handling accident and loss-of-coolant accident (LOCA) analyses and had identified one additional SSC, the standby liquid control (SLC) system, which was included within the scope of license renewal. The staff determined that the applicant had reconciled the difference between the CLB definition of safety related and the definition in 10 CFR 54.4(a)(1).

The staff reviewed a sample of the license renewal scoping results for portions of the EESW system and RHR complex support equipment and corresponding structures to provide additional assurance that the applicant adequately implemented its scoping methodology with respect to 10 CFR 54.4(a)(1).

The staff verified that the applicant 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 and 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 criteria in 10 CFR 54.4(a)(1).

2.1.4.1.3 Conclusion

Based on its review of the LRA, the applicant's implementing procedures and reports, and the review of two systems on a sampling basis, the staff concludes that the applicant's methodology for identifying safety-related SSCs relied on to remain functional during and following DBEs and including them within the scope of license renewal is consistent with the SRP-LR and 10 CFR 54.4(a)(1) and, therefore, is acceptable.

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

2.1.4.2.1 Summary of Technical Information in the Application

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

LRA Section 2.1.1.2, "Application of Criterion for Nonsafety-Related SSCs Whose Failure Could Prevent the Accomplishment of Safety Functions," states, in part:

> <u>Functional Support for Safety-Related SSC 10 CFR 54.4(a)(1) Functions</u>. At Fermi 2, 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. For the exceptions where nonsafety-related equipment is required to remain functional to support a safety function (e.g., support the fuel pool cooling and cleanup system in removing decay heat from fuel assemblies stored in the fuel pools), 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.
>
> <u>Connected to and Provide Structural Support for Safety-Related SSCs</u>. For nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems), components within the scope of license renewal include the connected piping and supports up to and including the first seismic or equivalent anchor beyond the safety-nonsafety interface, or up to a point determined by alternative bounding criteria (such as a base-mounted component, flexible connection, or the end of a piping run).
>
> <u>Potential for Spatial Interactions with Safety-Related SSCs</u>. Moderate- and low-energy systems have the potential for spatial interactions of spray and leakage. Nonsafety-related systems and nonsafety-related portions of safety-related systems with the potential for spray or leakage that could prevent safety-related SSCs from performing their required safety function are within 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, or 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. Such SSCs include 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 2.0 states that the applicant's methodology is consistent with the guidance in Appendix F to NEI 95-10, Revision 6.

In addition, the staff's position (as discussed in the SRP-LR Section 2.1.3.1.2) is that the applicant should not consider hypothetical failures; instead, it should base its 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 pursuant to 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 pursuant to 10 CFR 54.4(a)(2).

<u>Nonsafety-Related SSCs Required to Perform a Function That Supports a Safety-Related SSC</u>. 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 describes the method used to identify those 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 UFSAR, plant drawings, the CECO database, and other CLB documents to identify the nonsafety-related systems and structures that function to support a safety-related system whose failure could prevent the performance of a safety-related intended function. The staff determined that the applicant had identified the nonsafety-related SSCs that performed a safety function or supported a safety system that would require the nonsafety-related SSC to be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

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

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs. The staff reviewed LRA Section 2.1.1.2.2, "Physical Failures of Nonsafety-Related SSCs," and the applicant's 10 CFR 54.4(a)(2) implementing procedure that describes the method used to identify nonsafety-related SSCs, directly connected to safety-related SSCs, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant had reviewed the safety-related to nonsafety-related interfaces for each mechanical system in order to identify the nonsafety-related components located between the safety- to nonsafety-related interface and license renewal structural boundary.

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

- seismic anchors
- equivalent anchors
- bounding conditions described in Appendix F to NEI 95-10, Revision 6 (i.e., 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 guidance in SRP-LR and the requirements of 10 CFR 54.4(a)(2).

The staff determined that additional information would be required to complete its review. RAI 2.1-1, dated October 20, 2014, states, in part:

> During the on-site scoping and screening methodology audit the staff reviewed the implementing document used by the applicant to identify nonsafety-related SSCs with the potential to affect safety-related SSCs, for inclusion within the scope of license renewal. The applicant's implementing document states that only nonsafety-related SSCs that had not been included within the scope of license renewal based on the potential for spray or leakage needed to be reviewed for nonsafety-related SSCs directly attached to safety-related SSCs to identify the portion of the nonsafety-related SSC up to the first anchor, equivalent anchor, or bounding condition, past the safety-related/nonsafety-related interface. The staff required additional information to determine that the applicant had identified the portion of the nonsafety-related SSC, past the safety-related/nonsafety-related interface, to be included within the scope of license renewal, up to and including an anchor, equivalent anchor or bounding condition in accordance with 10 CFR 54.4(a)(2).

By letter dated November 18, 2014, the applicant responded to RAI 2.1-1, which states, in part:

> During the audit, it was discussed that previous license renewal applications have shown that the identification of nonsafety-related fluid-filled SSCs within

scope due to spatial interaction per LRA Section 2.1.1.2.2(2) has typically enveloped the nonsafety-related SSCs meeting the criteria of LRA Section 2.1.1.2.2(1). This is because the seismic boundary is typically within the same space as the nonsafety-to-safety interface and all of the fluid-filled, nonsafety-related SSCs in that space are already included due to potential for spray or leakage.

In order to provide verification that the nonsafety-related fluid-filled SSCs necessary for seismic support of safety-related SSCs are included within scope and subject to aging management review, a review of the scoping and screening of the safety-to-nonsafety interfaces was performed. The review utilized the method described in detail below, consistent with the statements in LRA Sections 2.1.1.2.2(1) and 2.1.2.1.2.

The LRA drawings were reviewed to identify instances where nonsafety-related fluid-filled SSCs are directly connected to safety-related SSCs. For each instance, the seismic boundaries were identified as (1) a seismic anchor, (2) an equivalent anchor, (3) a flexible connection, end of piping run, or base-mounted component, or (4) the seismic boundaries used for the design calculation. The seismic or equivalent anchors or other components credited for providing the boundaries were then located on piping isometrics. The locations of these boundary points on the piping isometrics were used to identify the corresponding locations on the LRA drawings. Then the LRA drawings were reviewed to determine if all the piping and components up to the boundary points were marked (highlighted) as subject to aging management review per 10 CFR 54.4(a)(2).

The results of the review confirmed that, for each safety-to-nonsafety interface, the connected fluid-filled piping and supports up to and including the first seismic or equivalent anchor (or up to a point determined by the alternative bounding criteria) were included as in scope and subject to aging management review in accordance with 10 CFR 54.4(a)(2). No new SSCs were identified as subject to aging management review as a result of this review. The review was performed consistent with the methodology described in LRA Sections 2.1.1.2.2(1) and 2.1.2.1.2. Therefore, no changes to the LRA are necessary.

The staff reviewed the response to RAI 2.1-1 and determined that the applicant had performed a review and had verified that fluid-filled, nonsafety-related SSCs attached to safety-related SSCs had been included within the scope of license renewal up to and including an anchor, equivalent anchor, or bounding condition in accordance with 10 CFR 54.4(a)(2). The staff's concern in RAI 2.1-1 is resolved.

<u>Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs</u>. The staff reviewed LRA Section 2.1.1.2.2 and the applicant's 10 CFR 54.4(a)(2) implementing procedure that describes 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 structure containing active or passive safety-related SSCs.

The staff determined that the applicant had identified all nonsafety-related SSCs containing liquid or steam that are located in spaces containing safety-related SSCs and had included the nonsafety-related SSCs within the scope of license renewal, unless the applicant had evaluated a nonsafety-related SSC and had determined that its failure 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 are 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 guidance in SRP-LR and the requirements of 10 CFR 54.4(a)(2).

2.1.4.2.3 Conclusion

Based on its review of the LRA and the applicant's implementing procedures and reports, selected system reviews and walkdowns, and the response to RAI 2.1-1, the staff concludes that the applicant's methodology for identifying and including nonsafety-related SSCs, whose failure could prevent satisfactory accomplishment of the intended functions of safety-related SSCs, within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4(a)(2) and, therefore, is acceptable.

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

2.1.4.3.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify SSCs included within the scope of license renewal in accordance with 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 describes 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 Commission's regulations for fire protection (10 CFR 50.48, "Fire Protection"), environmental qualification (EQ) (10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants"), anticipated transients without scram (ATWS) (10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plant"), and station blackout (SBO) (10 CFR 50.63, "Loss of

All Alternating Current Power"). The staff noted that pressurized thermal shock (PTS) (10 CFR 50.61, "Fracture Toughness Requirements for Protection against Pressurized Thermal Shock Events") was not applicable to Fermi 2, a boiling water reactor.

As part of this review, during the scoping and screening methodology audit, the staff reviewed implementing procedures and the technical basis documents, license renewal drawings, and scoping results reports. 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 reports. In addition, the staff determined that the scoping report results referenced the information sources used for determining the SSCs credited for compliance with the events.

<u>Fire Protection</u>. The staff reviewed the applicant's implementing procedure and technical basis document 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 UFSAR and the fire hazards analysis and safe shutdown analyses. The staff reviewed applicable portions of the LRA, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. In addition, the staff reviewed a selected sample of scoping reports for the systems and structures identified in technical documents. Based on its review of the CLB documents and the sample reports review, the staff determined that the applicant's methodology was adequate for identifying and including SSCs credited in performing fire protection functions within the scope of license renewal in accordance with 10 CFR 54.4(a)(3).

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

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

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

2.1.4.3.3 Conclusion

Based on its review of the LRA, the applicant's implementing procedures and reports, and systems on a sampling basis, the staff concludes that the applicant's methodology for identifying and including SSCs relied on to remain functional during regulated events is consistent with the SRP-LR and 10 CFR 54.4(a)(3) and, therefore, is acceptable.

2.1.4.4 Plant-Level Scoping of Systems and Structures

2.1.4.4.1 Summary of Technical Information in the Application

System and Structure Level Scoping. The applicant described the methods used to identify SSCs included within the scope of license renewal in accordance with 10 CFR 54.4(a) in LRA Section 2.1.1, which states:

> NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - License Renewal Rule (Ref. 2.1-6), provides industry guidance for determining what SSCs are in the scope of license renewal. The process used to determine the systems and structures within the scope of license renewal for Fermi 2 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 Fermi 2 Central Component (CECO) database was used to develop a list of plant systems. The equipment database is a controlled list of plant systems and components, with each component assigned to one plant system.

2.1.4.4.2 Staff Evaluation

The staff reviewed the applicant's methodology for identifying SSCs within the scope of license renewal to verify that it met the requirements of 10 CFR 54.4. 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, to determine whether the system or structure performed intended functions consistent with the criteria in 10 CFR 54.4(a), and to document the activities in scoping results reports. The process defined the plant in terms of systems and structures and was completed for all systems and structures onsite to ensure that the entire plant was assessed.

The staff determined that the applicant had identified the SSCs within the scope of license renewal and documented the results of the scoping process in reports in accordance with the implementing procedures. The reports included a description of the structure or system, a listing of functions performed by the system or structure, identification of the intended functions of the system or structure, the 10 CFR 54.4(a) scoping criteria met by the system or structure, references, and the basis for the classification of the intended functions of the system or structure. During the audit, the staff reviewed a sampling of the implementing documents and reports and determined that the applicant's scoping results contained an appropriate level of detail to document the scoping process.

2.1.4.4.3 Conclusion

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

2.1.4.5 Mechanical Component 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 10 CFR 54.4(a).

LRA Section 2.1.1 states:

> For mechanical system scoping, a system is defined as the collection of mechanical components in the equipment database assigned to the system code. System functions are determined based on the functions performed by those components. Defining a system by the components in the database is consistent with the evaluations performed for maintenance rule scoping and for the determination of system safety functions.

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 UFSAR, site Technical Specifications, the Fire Hazards Analysis (Appendix 9A.4 of the UFSAR), the Safe Shutdown Analysis, Maintenance Rule Basis documents, design basis documents, and station drawings as necessary. Each structure and mechanical system was evaluated against the criteria of 10 CFR 54.4 as described in the following sections [of the LRA]. Section 2.1.1.1 discusses the evaluation against the safety-related criterion in 10 CFR 54.4(a)(1). Section 2.1.1.2 discusses the evaluation of nonsafety-related SSCs against the criterion of 10 CFR 54.4(a)(2). Section 2.1.1.3 discusses the evaluation against the regulated events criterion, 10 CFR 54.4(a)(3).

2.1.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1, implementing procedures, reports, and the CLB source information associated with mechanical scoping. The staff determined that the CLB source information and the implementing procedure guidance used by the applicant were acceptable to identify mechanical SSCs within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project personnel and reviewed documentation pertinent to the scoping process during the scoping and screening methodology audit. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure was consistent with the description provided in LRA Section 2.1.1 and the guidance in SRP-LR Section 2.1 and was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping reports for portions of the EESW system and RHR complex support equipment and the process used to identify mechanical components that met the scoping criteria in 10 CFR 54.4. The staff reviewed the implementing procedures, verified that the applicant had used pertinent engineering and licensing information, and discussed the methodology and results with the applicant. As part of the review process, the staff evaluated the system's documented intended functions and the process used to identify system component types. The staff verified that the applicant had identified and highlighted license renewal drawings to identify the license renewal boundaries in accordance with the implementing procedure guidance. Additionally, the staff determined that the applicant had independently verified the results in accordance with the implementing procedures. The staff confirmed that the applicant's license renewal personnel tasked with verifying the results had performed independent reviews of the scoping reports and the applicable license renewal drawings. The staff confirmed that the systems and components identified by the applicant were evaluated against the criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3). The staff verified that the applicant had used pertinent engineering and licensing 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 its review of information in the LRA, implementing procedures, and the sampling review of scoping results, the staff concludes that the applicant's methodology for identifying mechanical SSCs within the scope of license renewal is in accordance with 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.6 Structural Component Scoping

2.1.4.6.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify structural SSCs within the scope of license renewal in accordance with 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 the UFSAR, plant layout drawings, Fire Hazard Analysis (Appendix 9A.4 of the UFSAR), design basis documents, and

> Maintenance Rule 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., foundations for freestanding tanks and electrical manholes). Tables 2.2-4 and 2.2-5 [of the LRA] list the plant structures evaluated for inclusion within the scope of license renewal.

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 UFSAR, site Technical Specifications, the Fire Hazards Analysis (Appendix 9A.4 of the UFSAR), the Safe Shutdown Analysis, Maintenance Rule Basis documents, design basis documents, and station drawings as necessary. Each structure and mechanical system was evaluated against the criteria of 10 CFR 54.4 as described in the following sections [of the LRA]. Section 2.1.1.1 discusses the evaluation against the safety-related criterion in 10 CFR 54.4(a)(1). Section 2.1.1.2 discusses the evaluation of nonsafety-related SSCs against the criterion of 10 CFR 54.4(a)(2). Section 2.1.1.3 discusses the evaluation against the regulated events criterion, 10 CFR 54.4(a)(3).

2.1.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1, implementing procedures, reports, and the CLB source information associated with structural scoping. The staff determined that the CLB source information and the implementing procedure guidance used by the applicant were acceptable to identify structural SSCs within the scope of license renewal. The staff conducted detailed discussions with the applicant’s license renewal project personnel and reviewed documentation pertinent to the scoping process during the scoping and screening methodology audit. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant’s procedure was consistent with the description provided in LRA Section 2.1.1 and the guidance in SRP-LR Section 2.1 and was adequately implemented.

On a sampling basis, the staff reviewed the applicant’s scoping reports for portions of the EESW system and RHR complex support equipment and corresponding structures and reviewed the process used to identify structural SSCs that met the scoping criteria in 10 CFR 54.4. The staff reviewed the implementing procedures, verified that the applicant had used pertinent engineering and licensing information, and discussed the methodology and results with the applicant. As part of the review process, the staff evaluated the structure’s documented intended functions and the process used to identify structural component types. Additionally, the staff determined that the applicant had verified the results in accordance with the implementing procedures. The staff confirmed that the applicant’s license renewal personnel verifying the results had performed independent reviews of the scoping reports and the applicable license renewal drawings. The staff confirmed that the SSCs identified by the applicant were evaluated against the criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3). The staff verified that the applicant had used pertinent engineering and licensing information in order to determine that systems and components 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 of the interior portion of selected site structures.

The staff determined additional information would be required to complete its review. RAI 2.1-2, dated October 20, 2014, states that, during the onsite scoping and screening methodology audit, the staff determined that the outage building, which is immediately adjacent to, and in contact with, the reactor building (included within the scope of license renewal in accordance with 10 CFR 54.4(1)), 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 outage building, which is located adjacent to, and in contact with, the reactor building, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The applicant responded to RAI 2.1-2, by letter dated November 18, 2014, which states, in part, that the portion of the reactor building that the outage building encompasses (personnel airlock), or is adjacent to (reactor building exterior wall), was designed to withstand impact loading attributable to tornado-generated missiles. The impact loading on the reactor building due to the postulated collapse of the outage building is bounded by the loading from tornado-generated missiles, as described in UFSAR Section 3.5.2.1, and would not impact the ability of the reactor building to perform its 10 CFR 54.4(a)(1) intended functions. Therefore, the outage building was not included within the scope of license renewal.

The staff reviewed the applicant's response to RAI 2.1-2 and determined that the applicant had provided a technical basis indicating that the failure of the nonsafety-related outage building could not impact the ability of the safety-related reactor building to perform its intended functions; therefore, the nonsafety-related outage building was not included within the scope of license renewal in accordance with 10CFR 54.4(a)(2). The staff's concern in RAI 2.1-2 is resolved.

2.1.4.6.3 Conclusion

Based on its review of information in the LRA, implementing procedures, the sampling review of scoping results, and the applicant's response to RAI 2.1-2, the staff concludes that the applicant's methodology for identifying structural SSCs within the scope of license renewal is in accordance with 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.7 Electrical Component Scoping

2.1.4.7.1 Summary of Technical Information in the Application

LRA Section 2.1.1 states:

> For the purposes of system level scoping, plant electrical and I&C systems are included within the scope of license renewal by default. Electrical and I&C components in mechanical systems are included in the evaluation of electrical and I&C components, regardless of whether the mechanical system is included in scope. Intended functions for electrical and I&C systems are not identified since the bounding (i.e., included by default) scoping approach 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 in NUREG-1800, Section 2.5.2.1.1 (Ref. 2.1-2).

2.1.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1 implementing procedures, reports, and the CLB source information associated with electrical scoping. The staff determined that the CLB source information and implementing procedure guidance used by the applicant was acceptable to identify electrical SSCs within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project personnel and reviewed documentation pertinent to the scoping process during the scoping and screening methodology audit. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure was consistent with the description provided in LRA Section 2.1.1 and the guidance in SRP-LR Section 2.1 and was adequately implemented.

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

2.1.4.7.3 Conclusion

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

2.1.4.8 Conclusion for Scoping Methodology

Based on its review of information in the LRA, implementing procedures, and a sampling review of scoping results, the staff concludes that the applicant's scoping methodology is consistent with the guidance in SRP-LR and identifies 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 regulations for fire protection, EQ, ATWS, SBO, and PTS. (The staff determined that PTS was not applicable to Fermi 2, a boiling water reactor; therefore, 10 CFR 50.61 was not applicable.) 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

After identifying systems and structures within the scope of license renewal, the applicant implemented a process for identifying SCs subject to an AMR in accordance with 10 CFR 54.21.

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 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 Fermi 2 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

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

The staff reviewed the methodology used by the applicant to identify the mechanical, structural, and electrical 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 10 CFR 54.21(a)(1). The staff determined that the screening process evaluated the component types and commodity groups included within the scope of license renewal to determine which ones were long lived and passive and therefore subject to an AMR. The staff reviewed on a sampling basis the screening results reports for the EESW system and RHR complex support equipment and corresponding structures. The applicant provided the staff with a detailed discussion of the processes used for each discipline and provided administrative documentation that described the screening methodology. Sections 2.1.5.2, 2.1.5.3, and 2.1.5.4 of this safety evaluation report (SER) discuss specific methodology for mechanical, structural, and electrical SCs.

2.1.5.1.3 Conclusion

Based on its review of the LRA, implementing procedures, and a sampling of screening results, the staff concludes that the applicant's screening methodology is consistent with the guidance contained in the SRP-LR and is 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 10 CFR 54.21. LRA Section 2.1.2.1, "Screening of Mechanical Systems," 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, basis documents, and the mechanical scoping and screening reports. The staff determined that the applicant used the screening process described in these documents along with the information in Appendix B to 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 in NEI 95-10. In addition, the staff determined that the applicant had evaluated the identified passive commodities to determine that they were not subject to replacement based on a qualified life or specified time period (long lived) and that the remaining passive, long-lived components were subject to an AMR.

The staff performed a sample review to determine whether the applicant had adequately implemented the screening methodology outlined in the LRA and implementing procedures. The staff reviewed portions of the EESW system and RHR complex support equipment screening reports and basis documents, conducted discussions with the applicant, and verified proper implementation of the screening process.

2.1.5.2.3 Conclusion

Based on its review of information in the LRA, implementing procedures, and the sampled mechanical screening results, the staff concludes that the applicant's methodology for identification of mechanical SCs, within the scope of license renewal and subject to an AMR, is in accordance with 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 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 (UFSAR, design basis documents, design specifications, site procedures and 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, basis documents, and the structural scoping and screening reports. The staff determined that the applicant used the screening process described in these documents along with the information contained in Appendix B to 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 components were determined to be subject to an AMR.

The staff performed a sample review to determine whether the applicant adequately implemented the screening methodology outlined in the LRA and implementing procedures. The staff reviewed portions of the EESW system and RHR complex support equipment and corresponding structures, conducted discussions with the applicant, and verified proper implementation of the screening process.

2.1.5.3.3 Conclusion

Based on its review of information in the LRA, implementing procedures, and the sampled structural screening results, the staff concludes that the applicant's methodology to identify structural SCs, within the scope of license renewal and subject to an AMR, is in accordance with 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 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, basis documents, and the electrical scoping and screening reports. The staff confirmed that the applicant had used the screening process described in these documents along with the information in Appendix B to 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 which ones were not subject to replacement based on a qualified life or specified time period (long lived) and that the remaining passive, long-lived components are subject to an AMR.

The staff performed a sample review of electrical commodity groups to determine whether the applicant had adequately implemented the screening methodology outlined in the LRA and implementing procedures. The staff determined that the electrical commodity groups (i.e., high voltage insulators, cables and connections, fuse holders, and the electrical portion of penetration assemblies) that the applicant had identified as passive, long-lived were subject to an AMR. During the scoping and screening methodology audit, the staff reviewed the electrical screening report and basis documents for these components, discussed the report with the applicant, and verified proper implementation of the screening process.

2.1.5.4.3 Conclusion

Based on its review of information in the LRA, implementing procedures, and the sampled electrical screening results, 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 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.5 Conclusion for Screening Methodology

Based on its review of the LRA, the screening implementing procedures, and a sample review of screening results, the staff concludes that the applicant's screening methodology is consistent with the guidance in the SRP-LR and identifies 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 the information presented in LRA Section 2.1; the supporting information in the scoping and screening implementing procedures and reports; the information presented during the scoping and screening methodology audit; sample system reviews; and the applicant's response, dated November 18, 2014, to the staff's RAIs dated October 20, 2014, the staff confirms 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). Based on this review, the staff concludes that the applicant's methodology for identifying systems and structures within the scope of license renewal and SCs that require 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 systems and structures that are relied on to mitigate DBEs, as required by 10 CFR 54.4(a)(1); systems and structures whose failure could prevent satisfactory accomplishment of any safety-related functions, as required by 10 CFR 54.4(a)(2); and systems and structures that are relied on in safety analyses or plant evaluations to perform functions, as required by 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 plant mechanical systems within the scope of license renewal. In LRA Table 2.2-3, "Plant Electrical and I&C Systems within the Scope of License Renewal," the applicant listed plant electrical and I&C systems within the scope of license renewal. In LRA Table 2.2-4, "Structures within the Scope of License Renewal," the applicant listed the structures that are within the scope of license renewal. Based on the DBEs considered in the plant's CLB, other CLB information on nonsafety-related systems and structures, and certain regulated events, the applicant identified plant-level systems and structures within the scope of license renewal, as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

In LRA Section 2.1, the applicant described its methodology for identifying systems and structures within the scope of license renewal and subject to an AMR. The staff reviewed the scoping and screening methodology; SER Section 2.1 includes the staff's evaluation. To verify that the applicant properly implemented its methodology, the staff focused its review on the implementation results shown in Table 2.2-1; Table 2.2-2, "Mechanical Systems Not within the Scope of License Renewal"; Table 2.2-3; Table 2.2-4; and Table 2.2-5, "Structures Not within the Scope of License Renewal" (as amended by letter dated May 9, 2016) of LRA Section 2.1 to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

The staff determined whether the applicant properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4. The staff reviewed systems and structures that the applicant did not identify as being within the scope of license renewal to verify whether the systems and structures have any intended functions that require their inclusion within the scope of license renewal. The staff conducted its review of the applicant's implementation 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, as amended by letter dated May 9, 2016, and 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 the following items:

- reactor coolant system (RCS)
- engineered safety feature (ESF) systems
- auxiliary systems
- steam and power conversion (S&PC) systems

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list those passive, long-lived SCs that are within the scope of license renewal and that are subject to an AMR. To verify the applicant properly implemented its methodology, the staff focused its review 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 that were subject to an AMR, thus confirming that there were no omissions.

The staff's evaluation of mechanical systems was performed using the evaluation methodology described in SRP-LR Section 2.3 and took into account the system function(s) described in the UFSAR. The objective was to determine whether 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 that have 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 issued an RAI to resolve any omissions or discrepancies identified.

2.3.1 Reactor Coolant System

LRA Section 2.3.1 identifies the reactor vessel, internals, and RCS SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the reactor vessel, internals, and RCS in the following LRA sections:

- LRA Section 2.3.1.1, "Reactor Assembly"
  - LRA Section 2.3.1.1.1, "Reactor Pressure Vessel and Appurtenances"
  - LRA Section 2.3.1.1.2, "Reactor Vessel Internals"
- LRA Section 2.3.1.2, "Reactor Coolant Pressure Boundary"
- LRA Section 2.3.1.3, "Nuclear Boiler"
- LRA Section 2.3.1.4, "Reactor Recirculation"
- LRA Section 2.3.1.5, "Neutron Monitoring"
- LRA Section 2.3.1.6, "Fuel and Reloads"
- LRA Section 2.3.1.7, "Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2)"

SER Sections 2.3.1.1 – 2.3.1.7 include the staff's findings on its review of LRA Sections 2.3.1.1 – 2.3.1.7, respectively.

2.3.1.1 Reactor Assembly

2.3.1.1.1 Summary of Technical Information in the Application

LRA Section 2.3.1.1 states that the reactor assembly system consists of the reactor pressure vessel (RPV) and appurtenances, including RPV internals components, such as the core, shroud, steam separator and dryer assemblies, and jet pumps.

The RPV and its appurtenances make up a fission product barrier and provide support to withstand adverse combinations of loading and forces resulting from normal, abnormal, and emergency conditions. The RPV is also part of the RCS pressure boundary. RPV subcomponents also provide structural support to safety-related equipment. The major subcomponents of the RPV include the shell, bottom head, top head, flanges, studs, nuts, bushing, nozzles, caps, welds, and safe ends.

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

The RPV internals provide a continuous internal circulation path for the core coolant flow; direct the flow of coolant water from various sources; separate moisture from the steam leaving the vessel; sense the differential pressure across the core support plate; and locate laterally, and support, the fuel assemblies, control rod guide tubes, and steam separators. Some of the reactor vessel internals include the following:

- core spray lines and spargers
- differential pressure and standby liquid control line
- feedwater spargers
- fuel supports
- jet pump assembly
- top guide assembly

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

The intended functions of the reactor assembly component types that are within the scope of license renewal include the following:

- to provide structural integrity for reactor vessel internals
- to provide a volume in which the core can be submerged in coolant
- to provide a floodable inner volume following a LOCA
- to provide a barrier to the release of radioactive materials
- to maintain the RCPB
- to maintain reactor core geometry
    - to provide a floodable volume in which the core can be adequately cooled in the event of a breach in the RCPB external to the reactor vessel
    - to provide correct coolant distribution
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function (steam dryer assembly)

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1 and the UFSAR 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 reactor assembly 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).

2.3.1.1.3 Conclusion

Based on its evaluation, the staff concludes that the applicant has appropriately identified the reactor assembly system, RPV and appurtenances, and reactor vessel internals components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the reactor assembly system, RPV and appurtenances, and reactor vessel internals components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Coolant Pressure Boundary

2.3.1.2.1 Summary of Technical Information in the Application

LRA Section 2.3.1.2 states that the RCPB consists of all pressure-containing components that include pressure vessels, piping, pumps, and valves. However, the RCPB does not include the reactor vessel and its internals as it was described in the previous section. These listed components are described as follows:

- 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 system piping, which penetrates primary reactor containment
  - the second of the two valves normally closed during normal reactor operation in system piping, which does not penetrate primary reactor containment
  - the RCS safety relief valves (SRVs)

The major components for RCPB for scoping and screening review consist of the recirculation loop piping, pumps, and valves; feedwater piping and valves; main steam piping, valves, and SRVs; and portions of multiple systems connected to the reactor vessel.

The intended function of the systems for the RCPB includes maintaining the integrity of the RCPB.

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

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2 and the UFSAR 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 RCPB 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).

2.3.1.2.3 Conclusion

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

2.3.1.3 Nuclear Boiler

2.3.1.3.1 Summary of Technical Information in the Application

LRA Section 2.3.1.3 states that the nuclear boiler system provides the steam transport path from the reactor vessel to the second main steam isolation valve (MSIV). The nuclear boiler system also consists of the feedwater piping from the feedwater isolation valves to the reactor vessel. The nuclear boiler system is part of the RCPB and supplies steam for the high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) pump turbines.

The major components for the nuclear boiler system are as follows:

- two trains of feedwater piping from the isolation valves to the RPV inlet nozzles
- feedwater isolation valves on each feedwater loop
- four main steam lines from the RPV steam outlet nozzles to the MSIVs
- main steam flow elements located on each steam line inside containment
- two MSIVs on each main steam line
- 15 SRVs mounted on the main steam lines
- SRV discharge piping
- vacuum break valves on each SRV discharge line
- quenching devices installed at the ends of the SRV discharge lines in the suppression pool

The intended functions of the nuclear boiler system component types within the scope of license renewal include the following:

- to prevent over-pressurization of the RCPB by using a pressure relief system
- to limit the coolant blowdown rate from the reactor vessel in the event of a main steam line break outside the containment
- to control radioactive material release and exposure to plant personnel during planned operations, abnormal operational transients, and accidents
- to provide a coolant injection path for the HPCI, RHR, RCIC, and reactor water cleanup system
- to support primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements

LRA Sections 2.3.1.2, 2.3.2.1, 2.3.3.6, 2.3.3.16, and 2.3.1.7 identify the components types that are within the scope of license renewal and that are subject to an AMR.

2.3.1.3.2 Staff Evaluation

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

During its review, the staff evaluated the system functions described in the LRA and 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).

2.3.1.3.3 Conclusion

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

2.3.1.4 Reactor Recirculation

2.3.1.4.1 Summary of Technical Information in the Application

LRA Section 2.3.1.4 states that the reactor recirculation system pumps reactor coolant through the reactor core and controls reactor power levels through the effects of coolant flow rate on the moderator void content. The reactor recirculation system contains two external loops, each consisting of a single stage, variable speed, centrifugal pump; suction and discharge gate valves; flow measuring element; controls and instrumentation; and associated piping. A motor-generator set provides power of variable frequency and voltage to the electric motor that drives the recirculation pump for each loop. The reactor recirculation system loops are located inside the primary containment.

The intended functions of the reactor recirculation system component types within the scope of license renewal include the following:

- to provide a flow path for shutdown cooling and for low-pressure coolant injection (LPCI) into the vessel
- to support emergency equipment cooling water (EECW) system pressure boundary
- to maintain the integrity of the RCPB
- to support primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Sections 2.3.1.2, 2.3.3.6, 2.3.3.5, and 2.3.1.7 identify the components that are within the scope of license renewal and that are subject to an AMR.

2.3.1.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.4 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and 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).

2.3.1.4.3 Conclusion

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

2.3.1.5 Neutron Monitoring

2.3.1.5.1 Summary of Technical Information in the Application

LRA Section 2.3.1.5 states that the neutron monitoring system provides indication of neutron flux that can be correlated to power level for all flux condition ranges that occur in the reactor core. The system consists of incore detectors and out-of-core electronic monitoring equipment. The six major subsystems are:

- source range monitors
- intermediate range monitors

- local power range
- traversing incore probes
- average power range monitors
- rod block monitors

The intended functions of the neutron monitoring system component types within the scope of license renewal include the following:

- to maintain the integrity of the RCPB
- to support primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function

LRA Sections 2.3.1.1.2, 2.3.2.6, and 2.3.1.7 identify the components types that are within the scope of license renewal and that are subject to an AMR.

2.3.1.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.5 and UFSAR Sections 7.1.2.1.4 and 7.6.1.13 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA 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).

2.3.1.5.3 Conclusion

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

2.3.1.6 Fuel and Reloads

2.3.1.6.1 Summary of Technical Information in the Application

LRA Section 2.3.1.6 states that the fuel and reloads system represents the 764 fuel assemblies in the reactor core. The fuel assemblies are high-integrity components containing the fissionable material that sustains the nuclear reaction when the reactor core is made critical.

The intended function of the fuel and reloads system within the scope of license renewal is to maintain the integrity of reactor fuel assemblies.

UFSAR Sections 4.1.2 and 4.2 provide additional details for components. The fuel and reloads system is not subject to an AMR because the fuel assemblies are replaced periodically.

2.3.1.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.6 and UFSAR Sections 4.1.2 and 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 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).

2.3.1.6.3 Conclusion

Based on its evaluation, the staff concludes that the applicant has appropriately identified the fuel and reloads system components within the scope of license renewal, as required by 10 CFR 54.4(a).

2.3.1.7 Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2)

2.3.1.7.1 Summary of Technical Information in the Application

LRA Section 2.3.1.7 summarizes scoping and screening for miscellaneous nonsafety-related RCSs or components that are within the scope of license renewal for 10 CFR 54.4(a)(2) because of potential physical interactions with safety-related components. These physical interactions could cause failure by causing a loss of structural or mechanical integrity of the safety-related SSC. The LRA also states that any functional failures of these nonsafety-related SSCs were identified and discussed within individual systems' evaluations of LRA Section 2.3.1 and are not evaluated in this section (i.e., Section 2.3.1.7).

LRA Section 2.3.1.7 lists the following systems as within the scope of license renewal based on the criteria in 10 CFR 54.4(a)(2) for physical failure:

- nuclear boiler
- reactor recirculation
- neutron monitoring

UFSAR sections for the nuclear boiler system, reactor recirculation system, and neutron monitoring system provide additional details for components subject to an AMR.

LRA Table 2.3.1-4-1, "Nuclear Boiler System Nonsafety-Related Components Affecting Safety-Related Systems Components Subject to Aging Management Review"; LRA Table 2.3.1-4-2, "Reactor Recirculation System Nonsafety-Related Components Affecting Safety-Related Systems Components Subject to Aging Management Review"; and LRA Table 2.3.1-4-3, "Neutron Monitoring System Nonsafety-Related Components Affecting Safety-Related Systems Components Subject to Aging Management Review," identify the component types that are within the scope of license renewal and that are subject to an AMR based on potential physical interactions.

2.3.1.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.7 and UFSAR sections for the nuclear boiler system, reactor recirculation system, and neutron monitoring system (as described in SER Sections 2.3.1.3, 2.3.1.4, and 2.3.1.5, respectively) 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).

2.3.1.7.3 Conclusion

Based on its evaluation, the staff concludes that the applicant has appropriately identified the miscellaneous RCS components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the miscellaneous RCS components 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 ESF SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the ESFs in the following LRA sections:

- LRA Section 2.3.2.1, “Nuclear Pressure Relief”
- LRA Section 2.3.2.2, “Residual Heat Removal”
- LRA Section 2.3.2.3, “Core Spray
- LRA Section 2.3.2.4, “High Pressure Coolant Injection”
- LRA Section 2.3.2.5, “Reactor Coolant Isolation Cooling”
- LRA Section 2.3.2.6, “Containment Penetrations”
- LRA Section 2.3.2.7, “Standby Gas Treatment”
- LRA Section 2.3.2.8, “Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2)”

SER Sections 2.3.2.1 – 2.3.2.8 include the staff’s findings on its review of LRA Sections 2.3.2.1 – 2.3.2.8, respectively.

2.3.2.1 Nuclear Pressure Relief

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 states that the nuclear pressure relief system (NPRS) is part of the nuclear boiler system and that its purpose is to limit any overpressure that occurs during abnormal operational transients. Pressure-operated SRVs are put in place to protect against overpressure by discharging steam from the nuclear supply system to the suppression pool. The SRVs are located on the main steam lines between the RPV and the first isolation valve within the drywell. The main protection functions provided by the SRVs are overpressure relief operation, overpressure safety operation, automatic depressurization system operation, and post-fire depressurization operation.

The intended functions of the NPRS component types within the scope of license renewal include the following:

- to prevent over-pressurization of the RCPB by use of a pressure relief system
- to reduce reactor vessel pressure in a LOCA situation in which the HPCI system fails to maintain the reactor vessel water level
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements

LRA Table 2.3.2-1, “Nuclear Pressure Relief System Components Subject to Aging Management Review,” identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA 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).

2.3.2.1.3 Conclusion

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

2.3.2.2 Residual Heat Removal System

2.3.2.2.1 Summary of Technical Information in the Application

LRA Section 2.3.2.2 states that the RHR system provides RHR capability during normal shutdown and restores and maintains the coolant inventory in the reactor vessel to adequately cool the reactor core following a LOCA. The RHR system removes heat from primary containment to reduce containment pressure and temperature by providing post-LOCA cooling for the drywell and suppression pool. The RHR system is also the ultimate heat sink for cooling of the safety-related plant equipment. The four modes of operation for the RHR system are shutdown cooling, containment cooling (containment spray and suppression pool cooling), LPCI, and fuel pool cooling assist.

The RHR system consists of two heat exchangers and four main system pumps that make two loops. Each RHR system loop has a heat exchanger, two main system pumps in parallel, and associated piping. The two loops of the RHR system are cross-connected by a single header, which makes it possible to supply either loop from the pumps in the other loop.

The intended functions of the RHR system component types within the scope of license renewal include the following:

- to restore and maintain water level in the reactor vessel for cooling after a LOCA
- to transfer reactor core decay heat and sensible heat from the containment to the RHR service water system after a LOCA
- to reduce containment pressure by spraying water into the suppression chamber
- to remove decay and sensible heat from the reactor core to cool down and maintain the reactor in a cold shutdown condition
- to assist the fuel pool cooling and cleanup system (FPCCS) in removing decay heat from fuel assemblies stored in the fuel pool
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.2-2, "Residual Heat Removal System Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.2; UFSAR Sections 5.2.1.1.10, 5.5.7, 6.2.2, 6.3.2, 7.1.2.1.27, 7.3.1.2.4, and 7.4.1.3; LRA Table 2.3.2-2; and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and updated final safety analysis report (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).

2.3.2.2.3 Conclusion

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

2.3.2.3 Core Spray

2.3.2.3.1 Summary of Technical Information in the Application

LRA Section 2.3.2.3 states that the core spray system provides low-pressure coolant flow to the core fuel elements following a LOCA. The core spray system gives protection to the core when the reactor vessel water level cannot be maintained during a large break in the nuclear system. Core spray, in regards to small breaks, provides protection when the reactor vessel water level cannot be maintained and the automatic depressurization system has operated to lower the reactor vessel pressure so that LPCI and core spray systems can provide core cooling.

The core spray system consists of two independent loops pumping cooling water from the suppression pool to independent spray spargers over the core. Each core spray loop consists of two motor-driven pumps with suction and discharge connected in parallel, a spray sparger in the reactor vessel above the core, piping and valves to convey water from the suppression pool to the pumps and to the sparger, and the associated controls and instrumentation.

The intended functions of the core spray system component types within the scope of license renewal include the following:

- to supply water to the reactor vessel for core cooling after a LOCA
- to maintain the integrity of the RCPB
- to support primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.2-3, "Core Spray System Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.2.3.2 Staff Evaluation

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

During its review, the staff evaluated the system functions described in the LRA and 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).

2.3.2.3.3 Conclusion

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

2.3.2.4 High Pressure Coolant Injection

2.3.2.4.1 Summary of Technical Information in the Application

The HPCI system provides reactor core cooling in the event of a small break LOCA that does not result in a rapid depressurization of the RCS. The HPCI system maintains adequate reactor water inventory until the reactor is depressurized to a pressure at which the LPCI system or core spray system can be placed in operation. The HPCI system consists of a steam turbine assembly; booster pump; gear reducer; main pump; barometric condenser; lubrication and control oil system; and associated piping valves, controls, and instrumentation.

The intended functions of the HPCI system component types within the scope of license renewal include the following:

- to provide reactor core cooling in the event of a small break LOCA that does not result in rapid depressurization of the RCS
- to maintain the integrity of the RCPB
- to support primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements

LRA Table 2.3.2-4, "High Pressure Coolant Injection System Components Subject to Aging Management Review," identifies the components types that are within the scope of license renewal and that are subject to an AMR.

2.3.2.4.2 Staff Evaluation

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

During its review, the staff evaluated the system functions described in the LRA and 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).

2.3.2.4.3 Conclusion

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

2.3.2.5 Reactor Core Isolation Cooling

2.3.2.5.1 Summary of Technical Information in the Application

LRA Section 2.3.2.5 states that the RCIC system provides makeup water for core cooling if the reactor is isolated coupled with a loss of feedwater flow from the reactor feedwater system. The RCIC system consists of a steam-driven turbine-pump unit and associated valves and piping to deliver makeup water to the RPV. The pump suction for the RCIC system is usually lined up to the condensate storage tank (CST) but is automatically switched to the suppression pool on a low CST level or when the suppression pool level is high.

The intended functions of the RCIC system component types within the scope of license renewal include the following:

- to provide makeup water to the reactor vessel following a reactor vessel isolation
- to maintain the integrity of the RCPB
- to support primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements

LRA Table 2.3.2-5, "Reactor Core Isolation Cooling System Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.2.5.2 Staff Evaluation

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

During its review, the staff evaluated the system functions described in the LRA 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).

2.3.2.5.3 Conclusion

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

2.3.2.6 Containment Penetrations

2.3.2.6.1 Summary of Technical Information in the Application

LRA Section 2.3.2.6 states that there are two passive provisions for containment of possible post-accident airborne contamination: (1) the primary containment system and (2) the secondary containment system. The primary containment penetrations are designed for peak transient conditions expected during a LOCA. They will withstand, or are shielded from, the forces caused by impingement of fluid from the rupture of the largest local pipe or connection. Penetrations in the primary and secondary containments provide openings for equipment or personnel to pass through the containment boundaries while still maintaining containment integrity. This review includes mechanical components associated with primary and secondary containment penetrations that were not reviewed with other systems.

LRA Table 2.3.2-6, "Containment Penetrations Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.2.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.6, UFSAR Section 6.2, and LRA Table 2.3.2-6 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).

2.3.2.6.3 Conclusion

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

2.3.2.7 Standby Gas Treatment

2.3.2.7.1 Summary of Technical Information in the Application

LRA Section 2.3.2.7 states that the purpose of the standby gas treatment system (SGTS) is to minimize the release-related offsite dose rates by permitting the venting and purging of both the primary and the secondary containment atmospheres under accident or abnormal conditions while containing any airborne particulate or halogen contamination that might be present.

A severe accident that is beyond the design basis of the plant may result in over-pressurization of the primary containment. The SGTS valves may be lined up to relieve this overpressure from the primary containment torus through the torus hardened vent system that discharges directly to the environment.

The intended functions of the SGTS component types within the scope of license renewal include the following:

- to minimize the release-related offsite dose rates
- to limit the unfiltered air from the secondary containment during periods of primary and secondary containment isolation
- to support the primary and secondary containment pressure boundaries

- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.2-7, "Standby Gas Treatment System Components Subject to Aging Management Review," identifies the remaining component types that are within the scope of license renewal, that are subject to an AMR, and that were not included in other system components reviews.

2.3.2.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.7; UFSAR Sections 6.2.3, 7.1.2.1.16, and 7.3.6; and LRA Table 2.3.2-7 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 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).

2.3.2.7.3 Conclusion

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

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

2.3.2.8.1 Summary of Technical Information in the Application

LRA Section 2.3.2.8 summarizes scoping and screening for miscellaneous nonsafety-related ESF systems or components that are within the scope of license renewal for 10 CFR 54.4(a)(2) because of potential physical interactions with safety-related components. These physical interactions could cause failure by causing a loss of structural or mechanical integrity of the safety-related SSC. The LRA also states that any functional failures of these nonsafety-related SSCs were identified and discussed within individual systems' evaluations of LRA Section 2.3.2 and are not evaluated in this section (i.e., Section 2.3.2.8).

LRA Section 2.3.2.8 lists the following systems as being within the scope of license renewal based on the criteria in 10 CFR 54.4(a)(2) for physical failure:

- RHR
- core spray
- HPCI
- RCIC

- primary containment penetrations
- SGTS

LRA Tables 2.3.2-8-1 – 2.3.2-8-6 identify the component types that are within the scope of license renewal and that are subject to an AMR for 10 CFR 54.4(a)(2) based on potential for physical interactions.

2.3.2.8.2 Staff Evaluation

The staff reviewed the miscellaneous ESF systems in scope for 10 CFR 54.4(a)(2) functions described in LRA Section 2.3.2.8 and UFSAR sections (as described in SER Sections 2.3.2.2 – 2.3.2.7) 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).

2.3.2.8.3 Conclusion

Based on its evaluation, the staff concludes that the applicant has appropriately identified the miscellaneous ESF systems and components within the scope of license renewal for 10 CFR 54.4(a)(2), as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the miscellaneous 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, “Control Rod Drive”
- LRA Section 2.3.3.2, “Standby Liquid Control”
- LRA Section 2.3.3.3, “Service Water”
- LRA Section 2.3.3.4, “Fuel Pool Cooling and Cleanup”
- LRA Section 2.3.3.5, “Emergency Equipment Cooling Water”
- LRA Section 2.3.3.6, “Compressed Air”
- LRA Section 2.3.3.7, “Fire Protection – Water”
- LRA Section 2.3.3.8, “Fire Protection – Carbon Dioxide and Halon”
- LRA Section 2.3.3.9, “Combustion Turbine Generator”
- LRA Section 2.3.3.10, “Emergency Diesel Generator”
- LRA Section 2.3.3.11, “Heating, Ventilation, and Air Conditioning”
- LRA Section 2.3.3.12, “Control Center Heating, Ventilation, and Air Conditioning”
- LRA Section 2.3.3.13, “Containment Atmospheric Control”
- LRA Section 2.3.3.14, “Plant Drains”
- LRA Section 2.3.3.15, “Fuel Oil”

- LRA Section 2.3.3.16, “Primary Containment Monitoring and Leakage Detection”
- LRA Section 2.3.3.17, “Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)”

SER Sections 2.3.3.1 – 2.3.3.17 include the staff’s findings on its review of LRA Sections 2.3.3.1 – 2.3.3.17, respectively.

2.3.3.1 Control Rod Drive

2.3.3.1.1 Summary of Technical Information in the Application

LRA Section 2.3.3.1 states the purpose of the control rod drive (CRD) hydraulic control system is to provide reactivity control by positioning the control rods to control power generation in the core. The CRD system is designed to insert the control rods, when required, with sufficient speed to prevent fuel damage from any abnormal operating transient. The control rods are part of the reactor assembly.

The CRD system includes the CRD mechanisms and the supporting hydraulic components, including pumps, accumulators, piping, valves, instruments, and controls.

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

- to insert all control rods into the core to quickly shut down the reactor in response to a manual or automatic signal
- to maintain the integrity of the RCPB
- to support the primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support ATWS (10 CFR 50.62), fire protection (10 CFR 50.48), and SBO (10 CFR 50.63) requirements

LRA Table 2.3.3-1, “Control Rod Drive System Components Subject to Aging Management Review,” identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1, UFSAR Sections 4.5.2.2 and 7.6.1.18, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted on license renewal boundary drawing LRA-M-5449 (H-6) that it could not locate a seismic or equivalent anchor on nonsafety-related line M-5881-1 continued to drawing LRA-M-2032-1 (D-7) from drawing LRA-M-2088 (B-4) and then continued to 1-2400-07 (D-8) and to safety-related valve F180. By letter dated November 26, 2014, the staff issued RAI 2.3.3.1-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchor between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.1-1, the applicant provided the location of a seismic anchor between the safety-related to nonsafety-related class change and safety-related valve F180 on license renewal drawing LRA-M-5449 (H-6). The piping encompassing the anchor is in scope per the criterion in 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.1-1 acceptable because it has provided the location of the seismic anchor which demonstrates an appropriate boundary between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.1-1 is resolved.

2.3.3.1.3 Conclusion

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

2.3.3.2 Standby Liquid Control

2.3.3.2.1 Summary of Technical Information in the Application

LRA Section 2.3.3.2 states that the purpose of the SLC system is to provide an alternate method of reactor core reactivity control in the event that the CRD system is not available. The system is sized to counteract the positive reactivity effect in decreasing power from rated power to the cold shutdown condition. The SLC system is also credited for injecting sodium pentaborate into the RCS after a design basis LOCA in order to control the emergency core cooling system (ECCS) water pH to prevent iodine re-evolution. The SLC system can be manually initiated to provide this function.

The major components of the SLC system consist of a storage tank, two positive displacement pumps, two explosive valves, and two check valves between the explosive valves and the reactor.

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

- to provide the capability of controlling suppression pool pH following a LOCA in the event of fuel failure
- to maintain the integrity of the RCPB
- to support the primary containment pressure boundary

- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support ATWS (10 CFR 50.62) and fire protection (10 CFR 50.48) requirements

LRA Table 2.3.3-2, “Standby Liquid Control System Components Subject to Aging Management Review,” identifies the SLC system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2; UFSAR Sections 1.2.2.10.1, 7.1.2.1.21, 4.5.2.4, 7.4.1.2, 5.2.1.1.9, 4.5.1.2.11, 7.7.1.2.3.1, 15.3, 3.9, and 15.8.1; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff’s review identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The staff noted on license renewal boundary drawing LRA-M-2082 (F-5) that it could not locate a seismic or equivalent anchor on nonsafety-related line M-3584 continued to drawing LRA-M-2678 and to safety-related valve F014. By letter dated November 26, 2014, the staff issued RAI 2.3.3.2-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.2-1, the applicant provided the location of an equivalent anchor between the safety-related to nonsafety-related class change and safety-related valve F014 on license renewal drawing LRA-M-2082 (F-5). The piping encompassing the anchor is in scope per the criterion in 10 CFR 54.4(a)(2).

The staff finds the applicant’s response to RAI 2.3.3.2-1 acceptable because it provided the location of an equivalent anchor. The staff’s concern described in RAI 2.3.3.2-1 is resolved.

In addition, the staff noted on license renewal boundary drawing LRA-M-2082 (F-3) that it could not locate a seismic or equivalent anchor on nonsafety-related line M-3584 continued from drawing LRA-M-2678 and the plant air system to safety-related storage tank (C4101A001). By letter dated November 26, 2014, the staff issued RAI 2.3.3.2-2 requesting that the applicant provide additional information to locate the seismic or equivalent anchor between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.2-2, the applicant stated that the safety-related storage tank C4101A001 is a base-mounted component and does not rely on the attached nonsafety-related piping to ensure seismic support.

The staff finds the applicant's response to RAI 2.3.3.2-2 acceptable because it explained why a seismic or equivalent anchor was not required. Therefore, the staff's concern described in RAI 2.3.3.2-2 is resolved.

By letter dated May 20, 2015, the staff issued RAI 4.1-4a, Parts a, b, and c, to the applicant. RAI 4.1-4a, Parts a and b, requested that the applicant justify why the structural integrity of the internal portions of the standby liquid control and core differential pressure (SLC/core ΔP) line has not been identified as an intended function for license renewal and would not be required to be within the scope of license renewal. Additionally, in RAI 4.1-4a, Part c, the staff requested that the applicant state the applicable aging effects requiring management that apply to the components and justify how it will manage these aging effects during the period of extended operation. This SER section documents the staff's evaluation of the applicant's response to RAI 4.1-4a, Parts a and b. SER Section 3.0.3.2.3 documents the staff's evaluation of the applicant's response to RAI 4.1-4a, Part c.

By letter dated July 6, 2015, the applicant responded to RAI 4.1-4a. The applicant also provided a supplemental response to RAI 4.1-4a by letter dated August 20, 2015. In response to Parts a and b, the applicant stated that, for the purpose of license renewal, it will assume that the SLC/core ΔP line internal to the reactor vessel does perform a license renewal intended function per 10 CFR 54.4(a)(3). Because the SLC system is within the scope of license renewal and because the SLC/core ΔP line internal to the vessel performs an intended function, the line is subject to an AMR. The SLC/core ΔP line internal to the vessel is stainless steel and is exposed to an environment of treated water greater than 140 °F. Based on this material/environment combination, the applicable aging effects requiring management are loss of material and cracking. The loss of material and cracking will be managed by the Water Chemistry Control – BWR Program as verified by the One-Time Inspection Program. The applicant also stated that it will manage cracking using the BWR Vessel Internals Program and will perform opportunistic inspections of the SLC/core ΔP line internal to the reactor vessel during the period of extended operation. SER Section 3.0.3.2.3 documents the staff's full evaluation of RAI 4.1-4a, Part c.

The staff finds the applicant's response acceptable because it stated that the SLC/core ΔP line internal to the vessel performs a license renewal intended function per 10 CFR 54.4(a)(3). The applicant also stated that because the SLC system is within the scope of license renewal and because the SLC/core ΔP line internal to the vessel performs an intended function, the line is subject to an AMR. The staff's concern described in RAI 4.1-4a, Parts a and b, is resolved.

2.3.3.2.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the standby liquid control system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.3.3 Service Water

2.3.3.3.1 Summary of Technical Information in the Application

LRA Section 2.3.3.3 includes the EESW system, residual heat removal service water (RHRSW) system, and RHR complex support equipment.

The EESW system provides cooling water to the EECW heat exchangers and transfer heat to the ultimate heat sink. The system consists of two cooling water flow trains, Division I and Division II, that supply cooling water to the corresponding Division I and II EECW heat exchangers. Heat from the EECW heat exchangers is rejected to the reservoir heat sink or to the atmosphere through the mechanical-draft cooling towers.

The RHRSW system consists of two redundant cooling water flow trains, Division I and Division II, that supply cooling water to the corresponding Division I and II RHR heat exchangers. A cross-tie in Division II is provided at the discharge of a pair of RHRSW pumps and the RHR heat exchanger shell side discharge piping to facilitate flooding of the reactor vessel in the unlikely event that all RHR (LPCI) and core spray pumps fail to operate following a postulated LOCA.

The RHR complex consists of a water supply reservoir; a means for heat rejection (cooling towers); a makeup and decanting system; and associated pumps, piping, and instrumentation. The RHR complex also includes a standby power source comprising four emergency diesel generators (EDGs) and the related EDG service water (EDGSW) pumps and EESW pumps and the related components. The RHR complex reservoir consists of two one-half capacity reinforced-concrete structures. The reservoirs are connected by redundant valve lines to permit access to the combined inventory of the two reservoirs to either division in the event of a mechanical failure in one of the divisions.

A two-cell induced-draft cooling tower is located over each division reservoir. Each tower cools one division of the plant load (return flow from one RHRSW loop, one EESW loop, and two EDGSW loops).

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

- to transfer heat from the EECW and RHR heat exchangers to the ultimate heat sink
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements
- to provide cooling of service water returned from safety-related plant equipment
- to maintain a source of cooling water for the RHRSW, EESW, and EDGSW systems

LRA Table 2.3.3-3, "Service Water System Components Subject to Aging Management Review," identifies the service water system component types that are within the scope of license renewal and that are 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 and 9.2.5, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted during its review of the drawings and locations in Table 2.3-1 below, that it could not locate continuation of piping within the scope of license renewal; therefore, the staff could not verify the scoping of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.3-1 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following information: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-1 Service Water System Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-2083	C-8	In-scope continuation to drawing I-2400-04. Drawing I-2400-04 was not provided.
LRA-M-2084	D-2	In-scope continuation to drawing I-2400-04. Drawing I-2400-04 was not provided.

In its response letter dated December 30, 2014, to RAI 2.3.3.3-1, the applicant stated that drawing I-2400-04 shows the two piping lines from drawings LRA-M-2083 and LRA-M-2084 continuing through valves, then continuing through sample roughing coolers, and then terminating at a sample panel. The piping, valves, and sample roughing coolers are in scope and subject to an AMR under "piping," "valve body," and "cooler housing." There are no additional component types subject to an AMR between the continuation to drawing I-2400-04 and the sample panel.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-1 acceptable because it provided the location of the scoping boundary and component types between the continuation and scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.3-1 is resolved.

The staff noted on license renewal boundary drawing LRA-M-2083 (C-8) and LRA-M-2084 (D-2) that it could not locate seismic or equivalent anchors on the 10 CFR 54.4(a)(2) nonsafety-related line continued from safety-related valve F080B to drawing I-2400-04 (D-4) and from safety-related valve F080A to drawing I-2400-04 (D-2). By letter dated November 26, 2014, the staff issued RAI 2.3.3.3-2 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.3-2, the applicant stated that the seismic design analysis demonstrates that the seismic boundaries are just past valves F080B and F080A, respectively. There is a transition to ¼-inch tubing just beyond valves F080A and F080B, and the seismic design analysis excludes the ¼-inch tubing based on the moment of inertia ratio.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-2 acceptable because it provided the basis for not needing a seismic anchor. The staff's concern described in RAI 2.3.3.3-2 is resolved.

2.3.3.3.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the service 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 has adequately identified the system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.4 Fuel Pool Cooling and Cleanup System

2.3.3.4.1 Summary of Technical Information in the Application

LRA Section 2.3.3.4 includes the FPCCS and the fuel-service and -handling equipment.

LRA Section 2.3.3.4 states that the purpose of the FPCCS is to remove the decay heat produced by stored spent fuel assemblies. The FPCCS cools the spent fuel pool by transferring decay heat through heat exchangers to the reactor building closed cooling water (RBCCW) system. The system consists of two fuel pool cooling pumps; two heat exchangers; two filter demineralizers; two skimmer surge tanks; and associated piping, valves, and instrumentation. The normal makeup water source for the system is provided from the CST to the skimmer surge tanks. The FPCCS does not serve any safety function.

The fuel-service and -handling equipment system consists of equipment used for moving fuel during refueling and other outage inspections and tasks, as well as spent fuel storage. Fermi 2 uses two types of high-density spent fuel storage racks. The Joseph Oat Corporation (OAT) racks use Boraflex as a neutron absorber; the Holtec International racks use Boral. The reactor vessel fuel storage equipment system includes the nonsafety-related new fuel racks, which provide structural support for new fuel.

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

- to backup makeup and cooling for spent fuel storage pool from the RHR system
- to support the secondary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to provide neutron absorption in the spent fuel pool
- to provide structural support of fuel assemblies in the spent fuel pool

LRA Table 2.3.3-4, “Fuel Pool Cooling and Cleanup System Components Subject to Aging Management Review,” identifies the FPCCS component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4; UFSAR Sections 1.2.2.15.2, 9.1.2.2.2, 7.6.1.15, 9.1.4.2, 9.1.3, and 12.1.1.1; Table 9.1-5, “Tools and Servicing Equipment,” in the UFSAR; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff’s review identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The staff noted on license renewal boundary drawing LRA-M-2048 (H-4) that it could not locate seismic anchors on nonsafety-related lines M-3631 (C-3) and M-3629 (B-5) to line M-3363 to safety-related valve F011. By letter dated November 26, 2014, the staff issued RAI 2.3.3.4-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.4-1, the applicant provided the location of a seismic anchor between the safety-related to nonsafety-related class change and safety-related valve F011 on license renewal drawing LRA-M-2048. The piping encompassing the anchor is in scope per the criterion in 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.4-1 acceptable because it provided the location of the seismic anchor. Therefore, the staff’s concern described in RAI 2.3.3.4-1 is resolved.

The staff also noted during its review of drawing LRA-M-2048 (E-8) that the continuation of piping within the scope of license renewal was not provided for line M-3608. By letter dated November 26, 2014, the staff issued RAI 2.3.3.4-2 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.3.4-2, the applicant stated that the pipe line from LRA-M-2048 continues to the hotwell and that there are no additional component types subject to an AMR between the continuation and the hotwell.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.4-2 acceptable because it provided the location of the scoping boundary and stated that there were no new component types between the continuation and the scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.4-2 is resolved.

2.3.3.4.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the FPCCS mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.3.5 Emergency Equipment Cooling Water System

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 states that the purpose of the EECW system is to supply cooling water to ESF equipment and other equipment required for a safe shutdown of the reactor. The EECW system consists of two cooling water flow trains, Division I and Division II, supplying cooling water to safety-related and select nonsafety-related equipment. Each division can be supplied with cooling water from a circulating EECW pump and EECW heat exchanger or from the RBCCW pumps and RBCCW heat exchangers.

Normally, the nonsafety-related RBCCW system supplies cooling water to both safety-related and nonsafety-related components supplied by the EECW piping system. Under normal operating conditions, the EECW pumps and heat exchangers are in standby mode.

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

- to supply cooling water to ESF equipment and other equipment required for a safe shutdown of the reactor
- to support the primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

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

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5; UFSAR Sections 1.2.2.9.21, 7.1.2.1.18, and 9.2.2; 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.

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).

2.3.3.5.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the EECW components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.6 Compressed Air System

2.3.3.6.1 Summary of Technical Information in the Application

LRA Section 2.3.3.6 addresses three systems as follows:

- station air, control air, and emergency breathing air systems
- reactor/auxiliary building superstructure, which includes compressed air components supporting the reactor building railroad airlock doors
- primary containment pneumatics (PCP) system, which includes both compressed air and compressed nitrogen components

LRA Section 2.3.3.6 states that the purpose of the station air and control air systems is to provide the plant with a reliable source of clean, dry, oil-free compressed air for plant operation. The station air system provides air for nonessential uses, such as for routine maintenance operations or in equipment process cycles, such as demineralizer backwashing. The control air system supplies air for I&C applications. The purpose of the emergency breathing air system is to provide breathing air to control room personnel if a potentially hazardous environment exists in the control room.

The control air system is divided into two parts: (1) interruptible and (2) non-interruptible. The non-interruptible control air supplies air to safety-related instruments and controls required to effect a safe reactor shutdown and control during long-term recovery.

The reactor/auxiliary building superstructure includes safety-related mechanical components that support the operation of the reactor building railroad airlock doors. These doors form part of the secondary containment pressure boundary.

The purpose of the PCP system is to provide pneumatic pressure for the activation of safety-related valves and other equipment inside the drywell. Supplied equipment includes nuclear pressure relief valves, containment isolation valves, testable/exercisable check valves, and the traversing incore probe purge valve assembly and indexing mechanism.

The intended functions of the compressed air systems within the scope of license renewal include the following:

- to provide sufficient air storage by safety-related accumulators to supply essential equipment during and following a postulated LOCA
- to provide an emergency source of breathing air for control room personnel use

- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements
- to support the primary and secondary containment pressure boundaries
- to provide pneumatic pressure for the activation of safety-related equipment

LRA Table 2.3.3-6, "Compressed Air Systems Components Subject to Aging Management Review," identifies the compressed air system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6; UFSAR Sections 6.4.2.5, 7.6.1.17, 7.1.2.1.32, 9.3.1, 6.2.1.2.2, 5.2.2.2, and 9.3.6; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted during its review of drawings that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. Drawing LRA-M-4615 shows that safety-related control air system lines are in scope for 10 CFR 54.4(a)(1). However, portions of lines at several locations throughout the drawing show continuations to dampers (D-3, D-4, and C-6); to instrument racks (with comment "to IR" at C-3, C-5, D-5, and D-7); to solenoid valves (with comment "to E/V" at locations D-5 through D-7 and C-8); and to positioners (B-4 and B-8) without clear representation of the components; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.6-1 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.3.6-1, the applicant stated that there are no additional component types subject to an AMR between the continuations to the dampers, instrument racks, solenoid valves, and the positioners and their corresponding license renewal boundaries. The passive compressed air pressure boundary components (valves, tubing, and piping) supporting the dampers or the boundary up to the racks are subject to an AMR, and there are no scoping changes across those continuations.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.6-1 acceptable because it provided the location of the license renewal boundaries and component types between the continuation and the scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.6-1 is resolved.

2.3.3.6.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the compressed air 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 10 CFR 54.21(a)(1).

2.3.3.7 Fire Protection – Water

2.3.3.7.1 Summary of Technical Information in the Application

LRA Section 2.3.3.7 states that the purpose of the fire protection system is to provide fire protection for all potential fire hazards. The fire protection system provides prompt fire detection, alarm, and suppression. Included in the fire protection system are a fire protection water supply and distribution system, fixed water spray and automatic sprinkler systems, gaseous extinguishing systems, and a fire detection and alarm system.

The water-based fire protection consists of manually operated hose stations and fire hydrants and manual and automatic sprinkler and water spray systems. All of these are supplied with water from an underground distribution loop that surrounds the Fermi 2 plant. The normal source of water to the fire water distribution loop is from the general service water (GSW) system via a jockey pump that takes suction from the GSW pump discharge header and pressurizes the fire protection water distribution loop. There are two fire water pumps located in the GSW pump house that automatically supply water directly from Lake Erie if the fire water loop pressure drops below pre-set limits.

The fire protection water system includes components from the GSW biocide injection system. The purpose of the GSW biocide injection system is to treat the GSW system with a biocide to inhibit slime and algae growth and to control organic and inorganic fouling of heat exchanger and piping surfaces.

The intended functions of the fire protection system with the scope of license renewal include the following:

- to support the safety-related pressure boundary of the control center heating, ventilation, and air conditioning (HVAC) system
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.3-7, "Fire Protection – Water System Components Subject to Aging Management Review," identifies the fire protection system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7 and 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 UFSAR Sections 9.5.1 and 9A, which describes the fire protection program for Fermi 2, and the guidelines of Appendix A to Branch Technical Position (BTP), "Auxiliary Power Conversion System Branch (APCSB) 9.5-1."

The staff also reviewed the following fire protection documents cited in the CLBs listed in the Fermi 2 Operating License Condition 2.C(9):

- NUREG-0798, Supplement 5, "Safety Evaluation Report Related to the Operation of Fermi 2," dated March 1985
- NUREG-0798, Supplement 6, "Safety Evaluation Report Related to the Operation of Fermi 2," dated July 1985

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 or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

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

The staff noted that LRA boundary drawing LRA-M-4548 shows Halon 1301 (Halon) and FM-200 (or clean agent) subfloor zone fire protection systems at locations C5 and E2 as not defined within the scope of license renewal (i.e., not colored in green).

By letter dated October 29, 2014, the staff issued RAI 2.3.3.7-1 requesting that the applicant verify whether the above Halon and FM-200 fire protection systems/components are within the scope of license renewal in accordance with 10 CFR 54.4(a) and whether they are subject to an AMR in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and are not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated December 1, 2014, to RAI 2.3.3.7-1, the applicant stated the following:

> Specific Halon fire protection system components in drawing LRA-M-4548 location C-5 are in scope and subject to an AMR while the components in location E-2 are not in scope and not subject to an AMR. Drawing LRA-M-4548 location C-5 depicts a typical Halon configuration for four sub-floor zones. Of these four zones represented by this typical configuration, only zone 13, the computer room sub-floor in the auxiliary building, performs a license renewal intended function. Although the components at location C-5 are not highlighted, those components associated with the computer room sub-floor in the auxiliary building are subject to an AMR and the component types and intended functions are included in LRA Table 2.3.3-8. LRA Table 3.3.2-8 provides the corresponding AMR results. The remaining sub-floor zones shown on drawing

> LRA-M-4548 locations C-5 and E-2 perform no license renewal intended function as they are not required for compliance with 10 CFR 50.48. These zones do not protect areas with safety-related equipment or equipment required for safe-shutdown.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-1 acceptable because it clarified that the Halon fire protection system components in drawing LRA-M-4548 location C-5 are within the scope of license renewal and subject to an AMR. The Halon fire protection system components in drawing LRA-M-4548 location E-2 are not within the scope of license renewal and are not subject to an AMR. Furthermore, the applicant explained that location C-5 in the drawing LRA-M-4548 Halon system consists of four zones, of which only one zone (zone 13) Halon fire suppression system and associated components are within the scope of license renewal and are subject to an AMR. The remaining three subfloor Halon fire suppression systems are not within the scope of license renewal because they perform no license renewal intended function and are not required for compliance with 10 CFR 50.48. These zones do not protect areas with safety-related equipment or equipment required for safe shutdown. Therefore, since there is no intended function associated with 10 CFR 54.4(a), the Halon fire suppression system and associated components at locations E-2 and C-5 (three subzones) were correctly excluded from the scope of license renewal and are not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.7-1 is resolved.

The staff noted during its review that use of the FM-200 fire protection system or the clean agent fire suppression system is limited to the radwaste building for various administrative areas, which do not include any systems or circuits credited for reactor shutdown in the event of a fire. Therefore, activation of the clean agent fire suppression system will not adversely affect the plant's ability to achieve and maintain shutdown in the event of a fire (UFSAR Section 9.5.1.2.3.6).

In RAI 2.3.3.7-2, dated October 29, 2014, the staff stated that LRA Section 2.3.3.7, on page 2.3-107, states that "the control center Heating, Ventilation and Air Conditioning (HVAC) makeup filter and recirculating filter charcoal adsorber units are each provided with water spray protection supplied from the fire water system…" The water spray fire protection system does not appear in LRA drawings as being within the scope of the license renewal and subject to an AMR. The staff requested that the applicant verify whether the above water spray fire protection system is within the scope of license renewal in accordance with 10 CFR 54.4(a) and is subject to an AMR in accordance with 10 CFR 54.21(a)(1). If the system is excluded from the scope of license renewal and is not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In a letter dated December 1, 2014, the applicant responded to RAI 2.3.3.7-2 by stating the following:

> The control center HVAC makeup filter charcoal adsorber unit is within the scope of license renewal and subject to an AMR. As shown on drawing LRA-M-2135-1 (F-2), zone 38 is the control center HVAC makeup filter charcoal adsorber unit. The isolation valve (F180) for zone 38 water spray system is shown as subject to an AMR on drawing LRA-M-2135 (F-5). Water spray system components are not shown on an LRA drawing, but are included in LRA Table 2.3.3-7.
>
> The control center HVAC recirculating filter charcoal adsorber unit is within the scope of license renewal and subject to an AMR. As shown on drawing

LRA-M-2135-1 (F-2), zone 39 is the control center HVAC recirculating filter charcoal adsorber unit. The isolation valve (F179) for zone 39 water spray system is shown as subject to an AMR on drawing LRA-M-2135 (F-5). Water spray system components are not shown on an LRA drawing, but are included in LRA Table 2.3.3-7.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-2 acceptable because it clarified that the zone 38 and zone 39 control center HVAC makeup filter and recirculating filter charcoal adsorber unit's water spray protection systems and associated components are included within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.7-2 is resolved.

In RAI 2.3.3.7-3, dated October 29, 2014, the staff stated that LRA Tables 2.3.3-7 and 3.3.2-7, "Fire Protection – Water System Summary of Aging Management Evaluation," do not include the following fire protection components:

- GSW biocide injection system components
- fire hose stations, fire hose connections, and hose racks
- pipe fittings, pipe supports, hangers, and couplings
- standpipe risers
- water spray nozzles
- floor drains for removal of fire water
- fuel storage tank for diesel fire pump
- turbine building roof smoke and heat vent housings

The staff requested that the applicant verify whether the fire protection 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 excluded from the scope of license renewal and are not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response, dated December 1, 2014, to RAI 2.3.3.7-3, the applicant stated the following:

> GSW biocide injection system has no intended function for 10 CFR 54.4(a)(1) or (a)(2), but does perform an (a)(3) function for fire protection (10 CFR 50.48). GSW biocide injection system components are not required for 10 CFR 50.48 except for valve F069 shown on drawing LRA-M-2135-1 (C-2) of the biocide injection system which is included within the scope of license renewal as it supports the pressure boundary of the fire water system. This valve is included in LRA Table 2.3.3-7 under the component type "Valve body" with AMR results in LRA Table 3.3.2-7.
>
> Fire hose stations are within the scope of license renewal and subject to an AMR. Hose stations are included in the structural AMR as component type "Fire hose reels." This item is included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4. Fire hose connections are within the scope of license renewal and subject to an AMR as indicated in LRA Table 2.3.3-7 under the component type "Piping" with AMR results in LRA Table 3.3.2-7. Hose racks are within the scope of license renewal and subject to an AMR. Hose racks are included in the structural AMR as component type "Fire hose reels." This item is included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4.

Pipe fittings are within the scope of license renewal and subject to an AMR. As stated in LRA Section 2.0, the term piping in component lists includes pipe and pipe fittings. Pipe fittings are included in LRA Table 2.3.3-7 under the component type “Piping” with AMR results in LRA Table 3.3.2-7. Pipe supports and hangers are within the scope of license renewal and subject to an AMR. Pipe supports and hangers are included in the structural AMR as support members. This item is included in LRA Table 2.4-4 AMR results in LRA Table 3.5.2-4. Couplings are within the scope of license renewal and subject to an AMR. Couplings are included in LRA Table 2.3.3-7 under the component type “Piping” with AMR results in LRA Table 3.3.2-7.

Standpipe risers are within the scope of license renewal and subject to an AMR. Standpipe risers are included in LRA Table 2.3.3-7 under the component type “Piping” with AMR results in LRA Table 3.3.2-7.

Water spray nozzles are within the scope of license renewal and subject to an AMR. Water spray nozzles are included in LRA Table 2.3.3-7 under the component type “Sprinkler” with AMR results in LRA Table 3.3.2-7.

Floor drains for removal of fire water are within the scope of license renewal and subject to an AMR. Floor drains are included in LRA Table 2.3.3-14 under the component type “Drain” with AMR results in LRA Table 3.3.2-14.

The fuel storage tank for the diesel fire pump is within the scope of license renewal and subject to an AMR. The fuel storage tank is included in LRA Table 2.3.3-15 under the component type “Tank” with AMR results in LRA Table 3.3.2-15.

Turbine building roof smoke and heat vent housings are within the scope of license renewal and subject to an AMR. The roof vent housings are included in the structural AMR as vents and louvers as part of component type “Miscellaneous steel.” This item is included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4.

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

The applicant indicated that only valve F069 associated with biocide injection system GSW shown on drawing LRA-M-2135-1, location C2, is included within the scope of license renewal. This valve is included in LRA Table 2.3.3-7 under the component type “Valve body” with AMR results in LRA Table 3.3.2-7.

Although the description of the “fire hose stations” and “hose racks” line items in LRA Table 2.3.3-7 does not list these components specifically, the applicant stated that it considers these line items to be included with the “Fire hose reels” in LRA Table 2.4-4, “Bulk Commodities Components Subject to Aging Management Review,” with AMR results in LRA Table 3.5.2-4, “Bulk Commodities Summary of Aging Management Evaluation.” Fire hose connections are included in the category of “Piping” in LRA Table 2.3.3 7 with AMR results provided in LRA Table 3.3.2-7.

The pipe fittings, couplings, and standpipe risers are included in LRA Table 2.3.3-7 with AMR results in LRA Table 3.3.2-7 under component type "Piping." Pipe supports and hangers are included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4 under "Structural support members."

Water spray nozzles are included in LRA Table 2.3.3-7 under the component type "Sprinkler" with AMR results in LRA Table 3.3.2-7.

The floor drains are included in LRA Table 2.3.3-14, "Plant Drains System Components Subject to Aging Management Review," under the component type "Drain" with AMR results in LRA Table 3.3.2-14, "Plant Drains Summary of Aging Management Evaluation."

The fuel storage tank is included in LRA Table 2.3.3-15, "Fuel Oil System Components Subject to Aging Management Review," under the component type "Tank" with AMR results in LRA Table 3.3.2-15, "Fuel Oil Systems Summary of Aging Management Evaluation."

The turbine building roof smoke and heat vent housings are included in the structural AMR as vents and louvers as part of component type "Miscellaneous steel." This item is included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-3 acceptable because it provided clarification that the fire protection system and components listed above are within the scope of license renewal and subject to an AMR as required by 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively. The staff's concern described in RAI 2.3.3.7-3 is resolved.

In RAI 2.3.3.7-4, dated December 17, 2014, the staff stated that LRA Section 2.3.3.7, "Fire Protection – Water," acknowledges that fire damper housings mounted in ductwork that are needed for compliance with 10 CFR 50.48 are addressed in LRA Section 2.3.3.11, "Heating, Ventilation, and Air Conditioning." LRA Table 2.3.3-11, "Heating, Ventilation and Air Conditioning System Components Subject to Aging Management Review," and LRA Table 3.3.2-11, "Heating, Ventilation and Air Conditioning Systems Summary of Aging Management Evaluation," include the component type "Damper housing" as a component subject to an AMR and list the intended function as "pressure boundary."

GALL Report Table IX.B, "Selected Definitions & Use of Terms for Describing and Standardizing Structures and Components," defines "ducting and components" as including fire dampers. However, the SRP-LR and the GALL Report do not differentiate between air control or air flow dampers and fire dampers that are needed for compliance with 10 CFR 50.48. If the fire damper assemblies are required for compliance with 10 CFR 50.48, then the appropriate intended function should be identified and maintained during the period of extended operation.

The staff requested that the applicant state whether the fire damper assemblies form part of the plant fire barriers. If so, the staff requested that the applicant explain why it did not identify fire damper assemblies as a fire barrier intended function in accordance with 10 CFR 54.4(b).

In a letter dated January 15, 2015, the applicant responded to RAI 2.3.3.7-4 by stating the following:

> The fire damper assemblies form part of the plant fire barriers. Fire damper housings are within the scope of license renewal. Where the fire dampers are in a wall, they are covered as a structural component as discussed in the response

to RAI 2.4.4-2. Where fire damper housings are in duct work, they are covered in the HVAC systems as the component type "damper housing" as shown in LRA Tables 2.3.3-11 and 2.3.3-12. As shown in LRA Tables 3.3.2-11 and 3.3.2-12, the effects of aging on damper housings are managed by the External Surfaces Monitoring Program and Internal Surfaces in Miscellaneous Piping and Ducting Components Program. This treatment is consistent with NUREG-1801, which includes housings for fire dampers in the category of "Ducting and components." Damper housings within ductwork are not included in the scope of NUREG-1801 XI.M26, Fire Protection. Ducting is included in XI.M36, External Surfaces Monitoring of Mechanical Components, and XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.

Further, the applicant stated that in LRA Section 2.1.1, Fermi 2 scoping was performed on a system and structure basis. LRA-Sections 2.3.3.11 and 2.3.3.12 both identify that the HVAC systems perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). This is one of the functions that is the basis for including the systems within the scope of license renewal. At the component level, fire damper housings are assigned the pressure boundary intended function. Managing the effects of aging to assure the pressure boundary function of the damper housings ensures that the fire dampers remain capable of supporting the fire protection system level function that was the basis for inclusion in the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-4 acceptable because it clarified that the fire damper assemblies forming part of the plant fire barriers are included within the scope of license renewal and are subject to an AMR. The staff confirmed that the fire damper housings are included in HVAC systems in LRA scoping and screening Tables 2.3.3-11 and 2.3.3-12, "Control Center HVAC System Components Subject to Aging Management Review," under the structural component type "Damper housing." Furthermore, the staff confirmed that the effects of aging on damper housings are managed by the External Surfaces Monitoring Program and Internal Surfaces in Miscellaneous Piping and Ducting Components Program and are included in LRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801," under component type "Steel piping and components (internal surfaces), ducting and components (internal surfaces) exposed to air – indoor, uncontrolled (internal)" (item 3.2.1-44). The aging effects of damper housings within the HVAC ducting are managed under GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," and GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The staff's concern described in RAI 2.3.3.7-4 is resolved.

2.3.3.7.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR Sections 9.5.1 and 9A, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the fire protection system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.8 Fire Protection – Carbon Dioxide and Halon

2.3.3.8.1 Summary of Technical Information in the Application

LRA Section 2.3.3.8 states that the gaseous-based fire protection consists of carbon dioxide (CO_2) and Halon 1301 (Halon) suppression systems and manually operated CO_2 hose stations.

The CO_2 suppression systems protect the EDGs in the RHR complex and areas in the auxiliary building. All of the systems normally operate fully charged up to a closed master valve. Halon suppression systems protect areas located in the auxiliary and service buildings, guard house, and office building annex. All of the systems normally operate fully charged up to an automatic discharge valve, which is closed.

The intended function of the CO_2 and Halon suppression systems within the scope of license renewal include the following:

- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.3-8, "Fire Protection – Carbon Dioxide and Halon System Components Subject to Aging Management Review," identifies the CO_2 and Halon suppression 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 relevant LRA drawings using the evaluation methodology described in the SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff also reviewed UFSAR Sections 9.5.1 and 9A and the guidelines of Appendix A to BTP APCSB 9.5-1.

The staff also reviewed the following fire protection documents cited in the CLBs listed in the Fermi 2 Operating License Condition 2.C(9):

- NUREG-0798, Supplement 5, "Safety Evaluation Report Related to the Operation of Fermi 2," dated March 1985
- NUREG-0798, Supplement 6, "Safety Evaluation Report Related to the Operation of Fermi 2," dated July 1985

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).

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

In RAI 2.3.3.8-1, dated October 29, 2014, the staff stated that UFSAR Section 9.5.1.2.1, on page 9.5-5, states that "automatic CO_2 extinguishing systems are provided for diesel generator rooms, SGTS charcoal filters, switchgear room and selected cable tray areas." The CO_2

extinguishing systems in SGTS charcoal filters and selected cable tray areas do not appear in LRA drawings as being within the scope of license renewal and subject to an AMR. The staff requested that the applicant verify whether the above CO_2 extinguishing systems are within the scope of 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). If these systems are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In a letter dated December 1, 2014, the applicant responded to RAI 2.3.3.8-1 by stating the following:

> SGTS charcoal filter CO_2 systems are within the scope of license renewal in accordance with 10 CFR 54.4(a) and subject to an AMR as shown on drawings LRA-I-2649-1 (charcoal adsorbers at locations E-5 and B-5) and LRA-M-2709 (SGTS filter units at G-2/G-3). The cable tray area automatic CO_2 system is within the scope of license renewal in accordance with 10 CFR 54.4(a) and subject to an AMR as shown on drawing LRA-M-4548 (cable tray area elevation 631 feet at location G-8). This one area is the only cable tray area (8AB) provided with an automatic CO_2 extinguishing system.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-1 acceptable because it verified that the CO_2 extinguishing systems in SGTS charcoal filters and in cable tray areas are within the scope of license renewal and are subject to an AMR. The staff confirmed that these components are highlighted in LRA drawings LRA-I-2649-1, LRA-M-2709, and LRA-M-4548. Therefore, the staff's concern described in RAI 2.3.3.8-1 is resolved.

In RAI 2.3.3.8-2, dated October 29, 2014, the staff stated that LRA Tables 2.3.3-8 and 3.3.2-8, "Fire Protection – CO_2 and Halon System Summary of Aging Management Evaluation," do not include the following fire protection components:

- strainer and filter housing
- pipe fittings, supports, and couplings
- manually operated CO_2 hose stations

The staff requested that the applicant verify whether the fire protection 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 excluded from the scope of license renewal and are not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In a letter dated December 1, 2014, the applicant responded to RAI 2.3.3.8-2 by stating the following:

> There are no strainers or filter housings in the gaseous fire protection systems.
>
> Pipe fittings are within the scope of license renewal and subject to an AMR. As stated in LRA Section 2.0, the term piping in component lists includes pipe and pipe fittings. Pipe fittings are included in LRA Table 2.3.3-8 under the component type "Piping" with AMR results in LRA Table 3.3.2-8.

Supports are within the scope of license renewal and subject to an AMR. Supports are included in the structural AMR support members. This item is included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4. Couplings are within the scope of license renewal and subject to an AMR. Couplings are included in LRA Table 2.3.3-8 under the component type “Piping,” with AMR results in LRA Table 3.3.2-8.

Manually operated CO2 hose stations are within the scope of license renewal and subject to an AMR. Hose stations are included in the structural AMR as component type “Fire hose reels.” This item is included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4.

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

The pipe fittings and coupling are included in LRA Table 2.3.3-8 with AMR results in LRA Table 3.3.2-8 under the component type “Piping.” Supports are included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4 under “support members; welds; bolted connections; support anchorage to building structure.” Hose stations associated with the manually operated CO_2 system are included in LRA Table 2.4-4 with AMR results in LRA Table 3.5.2-4, under the component type “Fire hose reels.”

The applicant indicated that there are no strainers or filter housings in the gaseous fire protection systems.

The staff finds the applicant’s response to RAI 2.3.3.8-2 acceptable because it clarified 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 10 CFR 54.21(a)(1), respectively. The staff’s concern described in RAI 2.3.3.8-2 is resolved.

2.3.3.8.3 Conclusion

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

2.3.3.9 Combustion Turbine Generator

2.3.3.9.1 Summary of Technical Information in the Application

LRA Section 2.3.3.9 states that the purpose of the auxiliary electrical peaker combustion turbine generator (CTG) system is to provide an independent source of electrical power. The CTG system is used as an alternate source of power for SBO and for safe shutdown following a fire as part of the alternate shutdown system. The CTG system includes four oil-fired turbine generators; fuel oil storage tanks (FOSTs); a starting diesel for CTG 11-1; a standby diesel generator (DG) used to start CTG 11-2, 11-3, and 11-4; and associated support equipment, instruments, and controls.

CTG 11-1 is black start capable. CTG 11-1 is used as the alternate alternating current (AC) source for an SBO event and is used to support the dedicated shutdown panel’s response to an

Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979,” to 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” fire.

CTG 11-2, 11-3, or 11-4 also can be used as an alternate source of AC power; however, these alternate CTG units are not credited for SBO or for Appendix R safe shutdown.

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

- to support fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63) requirements

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

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9 and UFSAR Sections 7.5.2.5.2, 9A.4.7.11.2, 8.2.1.2, 9A.4.7.9.1, and 8.4 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).

2.3.3.9.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the CTG system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the CTG system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.10 Emergency Diesel Generator

2.3.3.10.1 Summary of Technical Information in the Application

LRA Section 2.3.3.10 states that the purpose of the EDG system is to provide power in the event of a loss of offsite power to the ESF electrical loads for safe reactor shutdown and to mitigate the consequences of a DBA. Standby AC power is supplied by four DGs. Each division is supplied by two DGs. The DG starts automatically on loss of voltage to its respective bus or following a LOCA indicated by low reactor water level or high drywell pressure. All EDGs start on low reactor water level or a high drywell pressure LOCA signal. However, if the ESS bus voltage is normal during a LOCA, the DGs will idle at synchronous speed and rated voltage with the EDG output breakers open.

Each EDG unit is rated for a continuous electric capacity of 2,850 kW. Each EDG unit is housed in its own room in the RHR complex. The supporting subsystems include fuel oil, air start, service water, jacket cooling water, lubricating oil, and combustion air and exhaust.

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

- to provide power, in the event of a loss of offsite power, to the ESF electrical loads for safe reactor shutdown and to mitigate the consequences of a DBA
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.3-10, "Emergency Diesel Generator System Components Subject to Aging Management Review," identifies the EDG system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10; UFSAR Sections 8.3.1.1.8, 9.5.5, 9.2.5.2.3, 9.5.6, 9.5.4, and 9.5.7; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. During its review of the drawing and locations (indicated in Table 2.3-2 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.10-1 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-2 Emergency Diesel Generator System Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-N-2052	F-7, F-6, F-5 (two places), F-4, and C-7	Drawing continuations are not provided to the “RHR Reservoir” or “RHRSW.”
LRA-M-N-2053	F-5, F-4 (two places), F-3, F-2, and D-3	Drawing continuations are not provided to the “RHR Reservoir” or “RHRSW.”

In its response letter dated December 30, 2014, to RAI 2.3.3.10-1, the applicant stated that all the above continuations are open-ended piping lines that discharge directly into the RHR reservoir and that there are no additional component types subject to an AMR or scoping classification changes between the continuations and the end of the scoping boundary.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.10-1 acceptable because the continuations to the RHR reservoir are open-ended piping lines that discharge directly into the RHR reservoir and because there are no additional component types or scoping classification changes. Therefore, the staff’s concern described in RAI 2.3.3.10-1 is resolved.

2.3.3.10.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the EDG system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the EDG system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.11 Heating, Ventilation, and Air Conditioning

2.3.3.11.1 Summary of Technical Information in the Application

LRA Section 2.3.3.11 states that the HVAC components are divided into separate systems. These separate systems are the dedicated shutdown systems, the reactor/auxiliary building ventilation systems, the primary containment atmosphere cooling (PCAC) system, and the RHR complex and office service building (OSB) HVAC systems.

The purpose of the dedicated shutdown system is to provide a means to cool down and depressurize the reactor should a fire occur.

The purpose of the reactor/auxiliary building HVAC systems is to provide the required ambient environment for plant equipment, to provide a comfortable working environment for plant personnel, and to control airborne radioactivity.

The purpose of the PCAC system is to maintain the temperature of the drywell atmosphere within design conditions. The PCAC system is not credited for post-accident cooling.

The purpose of the RHR complex and OSB HVAC systems is to provide the required ambient environment for plant equipment and a comfortable working environment for plant personnel.

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

- to support the suppression pool, secondary containment, and EECW system pressure boundaries
- to provide cooling to maintain ESF equipment within design limits
- to prevent buildup of hydrogen in the ESF battery rooms
- to provide isolation capability of a plant heating steam line break
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

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

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11; UFSAR Sections 1.2.2.15.18, 1.2.2.15.4, 7.5.2.5, 9.3.3, 9.4.2, 9.4.3.2, 9.4.5, 9.4.6, 9.4.7, 9.4.8, 9.4.9, and 9.4.11; and LRA Table 2.3.3-11 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).

2.3.3.11.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the HVAC system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the HVAC system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.12 Control Center Heating, Ventilation, and Air Conditioning

2.3.3.12.1 Summary of Technical Information in the Application

LRA Section 2.3.3.12 states that the purpose of the control center HVAC system is to provide ventilation, heating, and cooling and to limit the relative humidity in the control center envelope during normal operation and following an accident. The control center envelope includes the main control room, office and conference room, cable spreading room, relay room, computer room, and mechanical equipment rooms. The SGTS rooms are included in the envelope during normal operation but are isolated from the envelope during emergency modes. The system has four modes of operation: (1) normal, (2) purge, (3) recirculation, and (4) chlorine.

The intended functions of the control center HVAC system within the scope of license renewal include the following:

- to maintain the control center environment to support continued operation of safety-related equipment and operator habitability following a DBA
- to limit the introduction of chlorine gas and airborne radioactivity into the control room and remove airborne radioactivity from the control room environment
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

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

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12; UFSAR Sections 1.2.2.9.24, 6.4, and 9.4.1; and LRA Table 2.3.3-12 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).

2.3.3.12.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the control center HVAC system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant has adequately identified the control center HVAC system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.13 Containment Atmospheric Control

2.3.3.13.1 Summary of Technical Information in the Application

LRA Section 2.3.3.13 states that the purpose of the containment atmospheric control system is to control the concentration of hydrogen and oxygen inside primary containment below combustible levels. Combustible gas control of the primary containment is provided by two separate subsystems: (1) the nitrogen inerting system and (2) the post-LOCA combustible gas control system. The nitrogen inerting system reduces oxygen inside the primary containment during normal operation by creating and maintaining a nitrogen atmosphere. The post-LOCA combustible gas control system may be used to limit the hydrogen and oxygen created following an accident by means of thermal recombination.

The intended functions of the containment atmospheric control system within the scope of license renewal include the following:

- to support primary containment and secondary containment pressure boundaries
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function

LRA Table 2.3.3-13, "Containment Atmospheric Control System Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.13; UFSAR Sections 1.2.2.9.22, 6.2.5, and 9.3.6; and LRA Table 2.3.3-13 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA 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).

2.3.3.13.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the containment atmospheric control system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant has adequately identified the containment atmospheric control system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14 Plant Drains

2.3.3.14.1 Summary of Technical Information in the Application

LRA Section 2.3.3.14 states that "plant drains" is the collective name for floor and equipment drains. The plant drains system includes components from system floor and equipment drains, radioactive waste, RHR complex drains, and OSB potable water.

The purposes of the plant drain systems are as follows:

- The purpose of the floor and equipment drains system is to collect and remove all waste liquids from their points of origin to a suitable disposal area in a controlled and safe manner.
- The purpose of the liquid radioactive waste, or radwaste, system is to segregate, collect, and process liquid waste generated throughout the plant.

- The purpose of the solid radwaste system is to handle and package solid waste.
- The purpose of the RHR complex drains and OSB potable water system is to provide miscellaneous drainage and plumbing equipment.

The radioactive waste systems include components that support the primary containment pressure boundary. The system also includes nonsafety-related components that prevent backflow from the radwaste building into the reactor building during the probable maximum meteorological event.

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

- to support the primary and secondary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements
- to prevent backflow from the radwaste building into the reactor building during the probable maximum meteorological event

LRA Table 2.3.3-14 identifies the plant drains system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14; UFSAR Sections 9.3.3, 1.2.2.14.4, 1.2.2.14.5, 3.4.4.4.2, 9.3.3, 9A.5, 11.2, 11.5, 9.2.4, and 9.3.3.2; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. During its review of the drawing and locations (indicated in Table 2.3-3 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.14-1 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-3 Plant Drains System Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-2032	G-7 and G-4	Drawings indicated by REF-I and REF-8 at location G-7 and REF-8 and REF-18 at location G-4 do not provide sufficient information to locate the license renewal boundary.
LRA-M-2032	D-2	Continuations from drawings M-2259 and M-4797; drawings M-2259 and M-4797 were not provided.
LRA-M-2032-1	D-4	Continuation was not provided for origin of M-2547 to turbine building equipment.
LRA-M-2223	B-6 and B-7	Continuations of five lines on drawings M-2048 and M-2833; drawings M-2048 and M-2833 were not provided.

In its response letter dated December 30, 2014, to RAI 2.3.3.14-1, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-1 acceptable because it provided sufficient information to locate the license renewal boundary and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.14-1 is resolved.

The staff also noted on the license renewal boundary drawings listed in Table 2.3-4 below that the staff could not locate seismic or equivalent anchors on 10 CFR 54.4(a)(2) nonsafety-related lines continued from safety-related lines as indicated in the table. By letter dated November 26, 2014, the staff issued RAI 2.3.3.14-2 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

Table 2.3-4 Plant Drains System Seismic or Equivalent Anchors Not within the Scope of License Renewal

LRA Drawing	Location	Issue
LRA-M-2032	D-4 and E-4	On drawing LRA-M-2032 (D/E-4) 10 CFR 54.4(a)(2), the nonsafety-related line continues from safety-related valve F 1409 in the reactor building to the turbine building and then to the radwaste building where it is taken out of scope. The staff could not locate a seismic or equivalent anchor on the 10 CFR 54.4(a)(2) nonsafety-related line continued to drawing M-2040 (G-8).

LRA Drawing	Location	Issue
LRA-M-2032	H-6	On drawing LRA-M-2032, location H-6, and drawing LRA-M-2032-1, location H-6, 10 CFR 54.4(a)(2) nonsafety-related lines continue from safety-related valves F600 and F018, respectively, to the not in-scope drywell floor drain pumps (G1101C00A and B and G110IC006A and B). The staff could not locate seismic or equivalent anchors on the 10 CFR 54.4(a)(2) nonsafety-related lines.
LRA-M-2032-1	H-6	

In its response letter dated December 30, 2014, to RAI 2.3.3.14-2, the applicant stated that valves F1407, F1408, and F1409 on drawing LRA-M-2032 and valves F1410, F1411, and F1412 on drawing LRA-M-2032-1 are not safety-related valves; therefore, there are no safety-nonsafety interfaces at the specified locations on those drawings.

The applicant provided additional information to locate seismic anchors at location H-4 on drawing LRA-M-2032. In addition, the applicant provided information to locate seismic and equivalent anchors at locations D-4 and D-6, respectively, on LRA-M-2032-1.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-2 acceptable because it provided the location of the seismic anchors or provided an explanation as to why the anchors were not needed. Therefore, the staff's concern described in RAI 2.3.3.14-2 is resolved.

2.3.3.14.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the plant drains system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the plant drains system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.15 Fuel Oil

2.3.3.15.1 Summary of Technical Information in the Application

LRA Section 2.3.3.15 states that the purpose of the fuel oil system is to transfer fuel oil to the EDGs, auxiliary electrical peaker CTG system, and fire protection system.

The EDG system includes fuel oil for operation of the DG and stores sufficient fuel for continuous operation of the EDG for 7 days. Each DG set is supplied by a 42,000-gal diesel fuel storage tank. Two redundant motor-driven fuel-oil transfer pumps deliver fuel from the storage tank to a 550-gal fuel oil day tank. Fuel flows by gravity from the day tank to the suction of the engine-driven fuel pump.

The CTG system (specifically CTG 11-1) is used as an alternate source of power for SBO and safe shutdown following a fire as part of the alternate shutdown system. Diesel fuel is maintained in the CTG fuel oil tank with a fuel level maintained by plant procedures to ensure nominal fuel availability for 72 hours of operations for a single CTG unit at a 10-MW load.

The fire pump diesel is provided with fuel oil from a 275-gal fuel oil tank for 8 continuous hours of operation. The diesel fire pump is a 2500-gpm diesel-driven fire pump located in the GSW pump house.

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

- to provide power, in the event of a loss of offsite power, to the ESF electrical loads for safe reactor shutdown and to mitigate the consequences of a DBA
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements

LRA Table 2.3.3-15 identifies the fuel oil system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15; UFSAR Section 9.5.1, 9.5.4 and 7.5.2.5.2; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted on drawing LRA-M-N-2048, locations E-6 and E-3, and drawing LRA-M-N-2049, locations E-6 and E-3, that it could not locate seismic anchors on the four nonsafety-related 4-inch-diameter lines to the safety-related diesel fuel oil tanks (R3000A002, R3000A001, R3000A004, and R3000A003). By letter dated November 26, 2014, the staff issued RAI 2.3.3.15-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.15-1, the applicant stated that, for all four locations, the Seismic II/I design analysis demonstrates that the seismic boundary is at the wall penetration from the RHR complex out into the yard.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.15-1 acceptable because it provided the location of the seismic anchors. Therefore, the staff's concern described in RAI 2.3.3.15-1 is resolved.

The staff also noted that LRA Table 2.2-1, "Mechanical Systems within the Scope of License Renewal," does not list Section 2.3.3.15, "Fuel Oil," as a system within the scope of license renewal. By letter dated November 26, 2014, the staff issued RAI 2.3.3.15-2 requesting that the applicant provide additional information to clarify why LRA Section 2.3.3.15 is not included in LRA Table 2.2-1.

In its response letter dated December 30, 2014, to RAI 2.3.3.15-2, the applicant stated that Table 2.2-1 lists systems by plant system number. There is no plant system number associated with fuel oil. The components containing fuel oil are part of other plant systems. For this reason, “fuel oil” is not listed as a separate system in LRA Table 2.2-1. LRA Section 2.3.3.15 includes the review of fuel oil components from the fire protection system, the auxiliary electrical peaker CTG system, and the EDG system. These three systems are separately listed in LRA Table 2.2-1. Within those sections, a reference to LRA Section 2.3.3.15 is provided for the AMR of components containing fuel oil.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.15-2 acceptable because it explained why the fuel oil system was not listed in LRA Table 2.2-1. Therefore, the staff’s concern described in RAI 2.3.3.15-2 is resolved.

2.3.3.15.3 Conclusion

Based on its evaluation discussed and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the fuel oil system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the fuel oil system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.16 Primary Containment Monitoring and Leakage Detection

2.3.3.16.1 Summary of Technical Information in the Application

LRA Section 2.3.3.16 states that the primary containment monitoring (PCM) and leakage detection system includes components from the following systems:

- PCM
- reactor protection
- reactor water cleanup
- main and reheat steam
- nuclear boiler
- main turbine generator and auxiliaries
- process sampling

The purpose of the PCM is to provide sufficient information to plant operators to permit normal operation, to assist in the assessment of consequences of an accident or incident, and to determine the effectiveness of control actions taken to mitigate the effects of the postulated event.

Leakage into systems that are directly or indirectly connected to the RCPB is detected by the leak detection system.

The intended functions of the PCM and leakage detection systems within the scope of license renewal include the following:

- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements
- to support the sensing line pressure boundary of the turbine first-stage pressure transmitters
- to monitor system flows to determine system leakage
- to maintain piping and component integrity to support post-accident plate-out of fission products from MSIV leakage
- to support operation of the reactor protection system (RPS) turbine first-stage pressure transmitters

LRA Table 2.3.3-16, "Primary Containment Monitoring and Leakage Detection System Components Subject to Aging Management Review," identifies the PCM and leakage detection systems component types that are within the scope of license renewal and that are subject to an AMR.

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16; UFSAR Sections 6.2.1.5, 3.6.2.2.5, 7.1.2.1.22, 5.5.8.2, 7.6.1.12, 7.6.1.8.8, 3.1.2.2.1, 1.2.2.15.13, 7.2, 9.3.2, and 11.4.4; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. During its review of the drawings and locations (indicated in Table 2.3-5 below), the staff noted that it could not locate continuations of piping within the scope of licensing renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.16-1 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-5 Primary Containment Monitoring and Leakage Detection System Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-2002	C-5 and D-5	Continuation was not provided for four 10 CFR 54.4(a)(2) lines to drawings I-2314-03 (location G-3), I-2336-05 (location C-6), and I-2346-08 (location D-6). Drawings were not provided.
LRA-M-2002	F-7, H-7, E-6, and F-5	Six in-scope 10 CFR 54.4(a)(2) drain lines continuing to LRA-M-2985 locations G-8, H-8, F-6, and G-6; could not locate continuations on LRA-M-2985.
LRA-M-2002	E-4 and F-5	Four in-scope 10 CFR 54.4 lines continuing to drawing LRA-M-2003 (F-3); review of drawing LRA-M-2003 could not locate continuations from drawing LRA-M-2002.
LRA-M-2002	F-5	10 CFR 54.4(a)(2) line continuing from unspecified drawing (and location) to valve F815.
LRA-M-2046	C-3, F-4, H-3, and F-6	Four in-scope 10 CFR 54.4(a)(2) lines to drawing I-2400-04, locations E-6, F-4, F-4, and F-4; drawing I-2400-04 was not provided.

In its response letter dated December 30, 2014, to RAI 2.3.3.16-1, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.16-1 acceptable because it provided the location of the scoping boundaries and component types between the continuation and scoping boundary. Therefore, the staff’s concern described in RAI 2.3.3.16-1 is resolved.

2.3.3.16.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the PCM and leakage detection system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the PCM and leakage detection system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

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

2.3.3.17.1 Summary of Technical Information in the Application

LRA Section 2.3.3.17 summarizes scoping and screening for miscellaneous nonsafety-related auxiliary systems or components that are within the scope of license renewal for 10 CFR 54.4(a)(2) because of potential physical interactions with safety-related components.

These physical interactions could cause failure by causing a loss of structural or mechanical integrity of the safety-related SSC. The LRA also states that, except for the following systems, any functional failures of these nonsafety-related SSCs were identified and discussed within individual systems' evaluations of LRA Section 2.3.3 and are not evaluated in this section (i.e., Section 2.3.3.17):

- process radiation monitoring
- torus water management
- local panel and racks
- off-gas process and vacuum
- potable water
- post-accident sampling
- GSW
- reactor building closed cooling water
- turbine building closed cooling water
- supplemental cooling chilled water
- auxiliary boiler
- waste oil
- online noble chemistry injection
- zinc injection
- storage pools
- turbine building HVAC
- turbine building potable water and plumbing
- beyond design basis external event mitigation (Fukushima)

LRA Section 2.3.3.17 also discusses the following miscellaneous auxiliary systems (i.e., in addition to the ones immediately above) as being within the scope of license renewal based on the criteria in 10 CFR 54.4(a)(2) for physical failure (these systems are discussed elsewhere in the LRA):

- CRD
- SLC
- radioactive waste
- reactor water cleanup
- fuel pool cooling and cleanup
- process sampling
- emergency equipment cooling water
- emergency equipment service water
- station air, control air, and emergency breathing air
- fire protection
- EDGs
- reactor/auxiliary building
- reactor/auxiliary building HVAC
- floor and equipment drains
- containment atmospheric control
- PCP
- PCM
- RHR complex and OSB HVAC
- RHR complex drains and OSB potable water

LRA Tables 2.3.3-17-1 – 2.3.3-17-37 identify the component types that are within the scope of license renewal and that are subject to an AMR for 10 CFR 54.4(a)(2) based on potential physical interactions.

2.3.3.17.2 Staff Evaluation

The staff reviewed the miscellaneous auxiliary systems in scope for 10 CFR 54.4(a)(2) functions described in LRA Section 2.3.3.17 and UFSAR sections 11.4, 9.2.8, 11.3.2.7, 9.2.4, 11.4.4, 1.2.2.15.8.2, 9.2.1, 7.6.1.14.1.1, 9.2.2, 7.6.1.14.1.2, 9.2.7, 9.2.9, 1.2.2.15.16, 9.4.8, 10.4.11, 5.2.3.4, 10.4.9, 9.4.4, and Table 3.10-3, (as described in SER Sections 2.3.3.1 – 2.3.3.17) 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).

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted on drawing LRA-M-2271 (E-6) that it could not locate seismic or equivalent anchors on nonsafety-related line M-3691 to safety-related valve F600, location E-6, or on the nonsafety-related line downstream of safety-related valve F601, location E-6. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-1, the applicant stated that a review of isometric drawings shows that there are expansion joints located on both sides of valves F600 and F601 and that the small-bore piping and the 6-inch piping lines going to valves F228 and F216 are excluded from the seismic design analysis based on the moment of inertia ratio.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-1 acceptable because there are expansion joints located on both sides of valves F600 and F601 and because the small-bore piping is excluded from the seismic design analysis based on the moment of inertia ratio. Therefore, the staff's concern described in RAI 2.3.3.17-1 is resolved.

One review method used by the staff is to confirm the inclusion of all components subject to an AMR by reviewing the results of the screening of components within the license renewal boundary. During its review of drawings and locations, the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. Drawing LRA-M-2271 (E-3) has an in-scope continuation "To Service Building." A drawing continuation is not provided for this continuation downstream of valve F187. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-2 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-2, the applicant stated that the piping shown is in the turbine building. The continuation beyond valve F187 is to the OSB. The continuation is not in scope from the point where it leaves the TB and goes to the OSB. The OSB is a structure that is not within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-2 acceptable because it provided sufficient information to locate the license renewal boundary and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.17-2 is resolved.

During its review of the drawings and locations (indicated in Table 2.3-6 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-3 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-6 Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-2017-IA	D-5	Has an in-scope continuation to drawing M-3804. Drawing M-3804 was not provided.
LRA-M-2017-2	G-1	Has an in-scope continuation to drawing I-2181-2. Drawing I-2182-2 was not provided.
LRA-M-2017-2	H-7	Has an in-scope continuation to the off-gas oxygen (O_2) analyzer. Drawing continuation is not provided for the continuation to the off-gas O_2 analyzer.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-3, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-3 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.3.17-3 is resolved.

During its review of drawings as supplied by the applicant, the staff noted that it could not locate continuations of piping within the scope of license renewal. Drawing LRA-I-2400-10, locations C-3, G-6, and D-6, has three in-scope continuations to drawing 61721-2400-11. The applicant did not provide drawing 61721-2400-11. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-4 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-4, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-4 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.3.17-4 is resolved.

In addition, the staff noted on drawing LRA-M-4100 that it could not locate seismic or equivalent anchors on nonsafety-related lines attached to safety-related valves F601 (location F-8), F603 (location D-6), F605 (location G-6), and F607 (location E-8). By letter dated November 26, 2014, that staff issued RAI 2.3.3.17-5 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interfaces and the end(s) of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-5, the applicant provided the location of the seismic anchors.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-5 acceptable because it provided the location of the seismic anchors which demonstrates an appropriate boundary between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.17-5 is resolved.

Furthermore, during its review of drawings and locations (indicated in Table 2.3-7 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-7 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-7 Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-4100	E-3	Drawing LRA-M-4100, location E-3, has an in-scope continuation to drawing 1-2400-03, location D-3. Drawing 1-2400-03 was not provided.
LRA-M-2008-1	B-7	Drawing LRA-M-2008-1, location B-7, has an in-scope continuation to drawing 1-2400-06, locations D-4 and D-5. Drawing 1-2400-06 was not provided.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-7, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-7 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.3.17-7 is resolved.

On drawing LRA-M-2008, location C-6, the scoping boundary ends at valves F847 and F848. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-8 requesting that the applicant provide additional information to clarify why lines 3314 and 3312 downstream of valves F847 and F848 are not within the scope of license renewal.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-8, the applicant stated that lines 3314 and 3312 past valves F848 and F847 transition to the OSB, which is not in scope.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-8 acceptable because it stated that the lines upstream of valves F848 and F847 transition to the OSB, which is not in scope. Therefore, the staff's concern described in RAI 2.3.3.17-8 is resolved.

The staff confirms the inclusion of all components subject to an AMR by reviewing the results of the screening of components within the license renewal boundary. On license renewal drawing LRA-M-2008-1 (D-2) the bus cooler (S1200B001) is not subject to an AMR. Similar components are included within the scope of license renewal and are subject to an AMR. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-9 requesting that the applicant provide additional information to clarify why bus cooler SJ 200B001 is not subject to an AMR as other coolers on drawing LRA-M-2008-1 are.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-9, the applicant stated that the other similarly depicted coolers are shell and tube coolers. Bus cooler S1200B001 is an open cooler housing that has turbine building closed cooling water (TBCCW) system piping inside the open housing. LRA Table 3.3.2-17-15, "Turbine Closed Cooling Water System Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation," addresses the piping inside the open housing.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-9 acceptable because it stated that this cooler is an open cooler versus shell and tube coolers. Therefore, the staff's concern described in RAI 2.3.3.17-9 is resolved.

Furthermore, during its review of drawings as supplied by the applicant, the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. Drawing LRA-M-2042 has eight in-scope continuations to and from drawing I-2314-02. The applicant did not provide drawing I-2314-02. By letter dated November 26, 2014, the staff issued RAI 2.3.3.17-10 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.3.17-10, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-10 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.3.17-10 is resolved.

By letter dated May 19, 2016, the applicant added a new system "Beyond Design Basis External Event Mitigation (Fukushima)", to the scope of LRA Section 2.3.3.17. This new system is intended to be used as part of the Flexible and Diverse Coping Strategy (FLEX) to mitigate beyond design basis external events (BDBEE) in response to NRC Order EA-12-049. The NRC staff reviewed the UFSAR drawings included with the May 26, 2016, submittal of Revision 20 to the Fermi 2 UFSAR and held a conference call with the applicant on June 9, 2016, to confirm the staff's understanding of the license renewal boundaries. In UFSAR Figures 5.5-13, sheets 1 and 2, corresponding with LRA drawings M-2083 and M-2084 respectively, the LRA boundary between the safety-related RHR system and non-safety BDBEE mitigation (Fukushima) system change at the inlet side of valves F621A and F621B. The piping and components downstream of these boundary valves, including the boundary valve, is subject to the same AMP as RHR piping and components. The piping and components upstream of the boundary valves is subject to the summary of aging management evaluation in Table 3.3.2-17-37, BDBEE Mitigation (Fukushima) System Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation. The UFSAR drawings also indicated a new piping connection, including normally closed isolation valves, between the HPCI test line piping and the GSW piping. In the June 9, 2016, conference call, the applicant informed the NRC staff that the entire connecting line, including the normally closed isolation valves, are in the scope of the aging management evaluation in Table 3.3.2-17-37. Based on the review of the UFSAR drawings and the clarification provided by the applicant, the NRC staff confirms the inclusion of all components subject to an AMR by reviewing the results of the screening of components within the license renewal boundary.

2.3.3.17.3 Conclusion

Based on its evaluation and review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified miscellaneous auxiliary systems within the scope of license renewal for 10 CFR 54.4(a)(2), as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the miscellaneous auxiliary systems in scope for 10 CFR 54.4(a)(2) components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion

LRA Section 2.3.4 identifies the S&PC systems SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the S&PC systems in the following LRA sections:

- LRA Section 2.3.4.1, "Condensate Storage and Transfer"
- LRA Section 2.3.4.2, "Feedwater and Standby Feedwater"
- LRA Section 2.3.4.3, "Miscellaneous 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 – 2.3.4.3 are in SER Sections 2.3.4.1 – 2.3.4.3, respectively.

2.3.4.1 Condensate Storage and Transfer

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 storage and transfer system is to store and distribute condensate and demineralized water for use throughout the plant during normal and shutdown plant conditions. The system provides condensate to the HPCI, RCIC, CRD, standby feedwater, and core spray systems and to the main condenser hotwell.

The condensate storage and transfer system includes two 600,000-gal storage tanks, the CST and the condensate return tank (CRT), a 50,000-gal demineralized makeup water storage tank, and three pumps with associated receiving and distribution lines. The CST standpipe is designed so that the last 150,000 gal is reserved for use by the HPCI or RCIC systems.

The intended functions of the condensate storage and transfer system within the scope of license renewal include the following:

- to support the flow path from the CST to the HPCI and RCIC systems
- to support the primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements

LRA Table 2.3.4-1, "Condensate Storage and Transfer System Components Subject to Aging Management Review," identifies the condensate storage and transfer system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1, UFSAR Sections 8.4 and 9.2.6, and 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).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. On drawing LRA-M-2678 (E-2), the staff could not locate seismic or equivalent anchors on the 10 CFR 54.4(a)(2) nonsafety-related line continued from safety-related valve 3120. The nonsafety-related line at E-2 continues to drawing I-2400-7, location D-4. The applicant did not provide drawing I-2400-7. The same 10 CFR 54.4(a)(2) nonsafety-related line from safety-related valve 3120 branches and continues to valves F314 and F315 at LRA-M-2678 (G-6 and F-6) and continues to M-5498 (H-3) and I-2400-06 (C-4), respectively. The applicant did not provide drawings M-5498 (H-3) and I-2400-06 (C-4). By letter dated November 26, 2014, the staff issued RAI 2.3.4.1-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.4.1-1, the applicant stated that there is a seismic anchor located in area E-3 on the 6-inch line (2152 and 2808) before valve V8-2789 and that this anchor exists before the tee intersection that leads to valves V23-2016, F314, and F315. Hence, the continuations are not required for seismic support of the safety-related piping. The piping encompassing the anchor is in scope in accordance with 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-1 acceptable because it provided the location of the seismic anchor. Therefore, the staff's concern described in RAI 2.3.4.1-1 is resolved.

2.3.4.1.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the condensate storage and transfer system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the condensate storage and transfer system components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.4.2 Feedwater and Standby 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 feedwater and standby feedwater system is to provide feed flow to the RPV. The feedwater system supplies heated feedwater to the reactor during normal plant power operation, and the standby feedwater system functions as a separate means of providing flow to the reactor from the CST.

The feedwater system consists of the reactor feed pumps, the sixth-stage high-pressure feedwater heaters, piping, valves, controls, and instrumentation. The standby feedwater system provides condensate from the CST to the feedwater system downstream of the sixth-stage feedwater heater. The standby feedwater system consists of two motor-driven pumps, piping, valves, controls, and instrumentation. The standby feedwater system can support plant shutdown from the dedicated shutdown panel.

The intended functions of the feedwater and standby feedwater system for license renewal include the following:

- to support the RCPB
- to support the primary containment pressure boundary
- to maintain the integrity of nonsafety-related components so that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function
- to support fire protection (10 CFR 50.48) requirements

LRA Table 2.3.4-2, "Feedwater and Standby Feedwater System Components Subject to Aging Management Review," identifies the feedwater and standby feedwater system component types that are within the scope of license renewal and that are subject to an AMR.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2; UFSAR Sections 9A.3.1.2, 7.1.1.2, 10.4.7, 7.1.2.1.9, 10.4.8, and 7.7.1.3; UFSAR Figure 7.1-1; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted on drawing LRA-M-2023 (F-8) that a 10 CFR 54.4(a)(2) nonsafety-related line continues from drawing LRA-M-2004-01 (H-2). The staff could not locate seismic or equivalent anchors on the 10 CFR 54.4(a)(2) nonsafety-related line continued from LRA-M-2004-01 (H-2). This line continues to 10 CFR 54.4(a)(1) safety-related valves F076A and F076B at locations F-1 and F-2. By letter dated November 26, 2014, the staff issued RAI 2.3.4.2-1 requesting that the applicant provide additional information to locate the seismic or equivalent anchors between the safety-nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated December 30, 2014, to RAI 2.3.4.2-1, the applicant stated that, for LRA-M-2023, the seismic analysis ends in areas H-2 and H-1 where the 24-inch lines (3131) from valves F076A and F076B connect to the 36-inch manifold (3103). There are equivalent anchors on the 24-inch lines before the connection to the manifold.

The staff finds the applicant's response to RAI 2.3.4.2-1 acceptable because it provided the location of the equivalent anchors. Therefore, the staff's concern described in RAI 2.3.4.2-1 is resolved.

One review method used by the staff is to confirm the inclusion of all components subject to an AMR by reviewing the results of the screening of components within the license renewal boundary. During its review of the drawings and locations (indicated in Table 2.3-8 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.4.2-2 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-8 Feedwater and Standby Feedwater System Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-M-2035	E-8	Could not find continuation from drawing LRA-M-2035, location E-8, to drawing LRA- M-2089, location H-4.
LRA-M-5715-4	D-4 and D-7	Continuations to and from LRA-M-5715-4 to and from drawing M-5715-3, locations D-6 and D-4, respectively, could not be found because M-5715-3 was not provided.

In its response letter dated December 30, 2014, to RAI 2.3.4.2-2, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.2-2 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.4.2-2 is resolved.

2.3.4.2.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the feedwater and standby feedwater system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the feedwater and standby feedwater system components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.4.3 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

2.3.4.3.1 Summary of Technical Information in the Application

LRA Section 2.3.4.3 summarizes scoping and screening of miscellaneous nonsafety-related S&PC systems or components that are within the scope of license renewal for 10 CFR 54.4(a)(2) because of the potential for physical interactions with safety-related components. These physical interactions could cause failure by causing a loss of structural or mechanical integrity of the safety-related SSC. The LRA also states that any functional failures of these nonsafety-related SSCs were identified and discussed within individual systems' evaluations of LRA Section 2.3.4 and are not evaluated in this section (i.e., Section 2.3.4.3).

LRA Section 2.3.4.3 lists the following systems as being within the scope of license renewal based on the criteria in 10 CFR 54.4(a)(2) for physical failure:

- main and reheat steam
- condensate
- feedwater and standby feedwater
- heater drains
- main turbine generator and auxiliaries
- condenser and auxiliaries
- circulating water
- condensate storage and transfer
- drips, drains, and vents

LRA Tables 2.3.4-3-1 – 2.3.4-3-9 identify the component types that are within the scope of license renewal and that are subject to an AMR for 10 CFR 54.4(a)(2) based on potential for physical interactions.

2.3.4.3.2 Staff Evaluation

The staff reviewed the miscellaneous S&PC systems in scope for 10 CFR 54.4(a)(2) functions described in LRA Section 2.3.4.3; UFSAR Sections 6.2.6, 9.2.1.2, 10.1, 10.2, 10.3, and 10.4; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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).

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. During its review of the drawings as supplied by the applicant, the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. Drawing LRA-M-2007 (D-5 through E-5, and D-6) has in-scope 10 CFR 54.4(a)(2) lines continuing to drawing I-2400-03 at four locations. The applicant did not provide drawing I-2400-03. By letter dated November 26, 2014, the staff issued RAI 2.3.4.3-1 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.4.3-1, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-1 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.4.3-1 is resolved.

One review method used by the staff is to confirm the inclusion of all components subject to an AMR review by reviewing the results of the screening of components within the license renewal boundary. During its review of the drawings and locations (indicated in Table 2.3-9 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.4.3-2 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-9 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Piping Continuation Issue
LRA-M-2011	H-4	An in-scope 10 CFR 54.4(a)(2) line continuing to drawing 6M721-2004 (drawing LRA-M-2004), location C-3. Could not locate the continuation from LRA-M-2011 on drawing LRA-M-2004.
LRA-M-2011	G-2, G-4, G-6, G-8, and D-3	In-scope 10 CFR 54.4(a)(2) lines to sample sink drain drawings on drawings I-2400-3 and I-2400-06. Drawings I-2400-3 and I-2400-06 were not provided.
LRA-M-2011-1	H-2	An in-scope 10 CFR 54.4(a)(2) line continuing to drawing M-3007. Drawing M-3007 was not provided.

In its response letter dated December 30, 2014, to RAI 2.3.4.3-2, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-2 acceptable because it provided sufficient information to locate the continuations and stated that there are no additional component types subject to an AMR between the continuation and the termination of the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.4.3-2 is resolved.

In addition, during its review of the drawings and locations as supplied by the applicant, the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. Drawing LRA-M-2017-1 (D-5) has a 2-inch diameter 10 CFR 54.4(a)(2) line continuing to an unspecified drawing (and location) with a note "At Condenser." By letter dated November 26, 2014, the staff issued RAI 2.3.4.3-3 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

In its response letter dated December 30, 2014, to RAI 2.3.4.3-3, the applicant stated the 2-inch diameter 10 CFR 54.4(a)(2) line continues to connection No. 101 on the condenser shell. A similar continuation can be seen at location F-5 from the west preheater at location F-5; the isometric for this piping is indicated as 4149. M-4149-1 shows the piping to the condenser connection No. 101. There are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of these lines.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-3 acceptable because it provided sufficient information to locate the scoping boundary and stated that there are no additional component types subject to an AMR between the continuations from, and the end of, scoping boundary. Therefore, the staff's concern described in RAI 2.3.4.3-3 is resolved.

In addition, during its review of the drawings and locations (indicated in Table 2.3-10 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.4.3-4 requesting that the applicant provide sufficient information to locate the license renewal boundary. The staff also requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-10 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Piping Continuation Issue
LRA-M-2985-1	F-3, D-4, and E-6	Drawing LRA-M-2985-1 has three in-scope 10 CFR 54.4(a)(2) lines continuing to drawings M-4352, I-2314-3, and I-2314-3. Drawings M-4352 and I-2314-3 were not provided.
LRA-M-2985-1	G-6	Drawing LRA-M-2985-1 (G-6) has a 10 CFR 54.4(a)(2) line continuing to drawing LRA-M-2017-1, location A-7. Review of drawing LRA-M-2017-1 could not locate the continuation from drawing LRA-M-2985-1.
LRA-M-2985-1	E-2 and E-3	Drawing LRA-M-2985-1 (E-2 and E-3) has two 10 CFR 54.4(a)(2) lines continuing to drawing LRA-M-2017-1 (F-6 and D-5). Review of drawing LRA-M-2017-1 could not locate the continuations from drawing LRA-M-2985-1.

In its response letter dated December 30, 2014, to RAI 2.3.4.3-4, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant’s response to RAI 2.3.4.3-4 acceptable because it provided sufficient information to locate the continuations and identify the license renewal boundaries and stated that none of these continuations have a change in scoping classification. Therefore, the staff’s concern described in RAI 2.3.4.3-4 is resolved.

Furthermore, during its review of the drawings and locations (indicated in Table 2.3-11 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.4.3-5 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-11 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Piping Continuation Issue
LRA-M-2003	F-4	Drawing LRA-M-2003 (F-4) has an in-scope 10 CFR 54.4(a)(2) line continuing to drawing M-4504-1. Drawing M-4504-1 was not provided.
LRA-M-2003	E-5 and F-5	Drawing LRA-M-2003 (E-5 and F-5) has an in-scope 10 CFR 54.4(a)(2) line continuing to drawing I-2314-03 (H-3). Drawing I-2314-03 was not provided.

In its response letter dated December 30, 2014, RAI 2.3.4.3-5, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-5 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation and the license renewal boundaries. Therefore, the staff's concern described in RAI 2.3.4.3-5 is resolved.

One review method used by the staff is to confirm the inclusion of all components subject to an AMR by reviewing the results of the screening of components within the license renewal boundary. During its review of the drawings and locations (indicated in Table 2.3-12 below), the staff noted that it could not locate continuations of piping within the scope of license renewal; therefore, the staff could not verify the scoping boundary of SSCs. By letter dated November 26, 2014, the staff issued RAI 2.3.4.3-6 requesting that the applicant provide sufficient information to locate the license renewal boundary. In addition, the staff requested the following: (1) if the continuation cannot be shown on license renewal boundary drawings, provide additional information describing the extent of the scoping boundary, (2) identify any additional component types subject to an AMR between the continuation and the termination of the scoping boundary, and (3) if the scoping classification of a piping section changes over the continuation, provide additional information to clarify the change in classification.

Table 2.3-12 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) Piping Continuations Not within the Scope of License Renewal

LRA Drawing	Location	Continuation Issue
LRA-I-2336-05	C-2, E-4, E-5, and E-6	Drawing LRA-I-2336-05 has four in-scope 10 CFR 54.4(a)(2) lines to drawings M-2165 and I-2334-20. Drawings M-2165 and I-2334-20 were not provided.
LRA-I-2336-06	B-7 and B-8	Drawing LRA-I-2336-06 (B-7 and B-8) has two in-scope 10 CFR 54.4(a)(2) lines continuing to drawing I-2333-07. Drawing I-2333-07 was not provided.

LRA Drawing	Location	Continuation Issue
LRA-I-2336-26	E-4	Drawing LRA-I-2336-26 (E-4) has an in-scope 10 CFR 54.4(a)(2) line continuing to drawing I-2334-05. Drawing I-2334-05 was not provided.
LRA-I-2336-26	D-4	Drawing LRA-I-2336-26 (D-4) has an 8-in.-diameter 10 CFR 54.4(a)(2) line continuing from an unspecified drawing (and location) with a note "From Guard Piping."
LRA-I-2346-05	E-7	Drawing LRA-I-2346-05 (E-7) has an in-scope 10 CFR 54.4(a)(2) line continuing to drawing I-2346-06. Drawing I-2346-06 was not provided.
LRA-I-2346-05	F-4, E-4, and D-4	Drawing LRA-I-2346-05 has three 10 CFR 54.4(a)(2) lines continuing to unspecified drawings with notes "To Portable Drum," "To Main Oil Tank," and "To Waste Oil Tank."

In its response letter dated December 30, 2014, to RAI 2.3.4.3-6, the applicant provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR or scoping classification changes between the continuation and the termination of the scoping boundaries.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-6 acceptable because it provided sufficient information to locate the license renewal boundaries and stated that there are no additional component types subject to an AMR between the continuation from, and the end of, the scoping boundaries. Therefore, the staff's concern described in RAI 2.3.4.3-6 is resolved.

2.3.4.3.3 Conclusion

Based on its evaluation and review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the miscellaneous S&PC systems and components within the scope of license renewal for 10 CFR 54.4(a)(2), as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the miscellaneous S&PC systems in scope for 10 CFR 54.4(a)(2) components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures

This section documents the staff's review of the applicant's scoping and screening results for containments, structures, and component supports evaluated as a commodity. Specifically, this section describes the following structures and structural components that are within the scope of license renewal:

- reactor/auxiliary building and primary containment
- water-control structures
- turbine building, process facilities, and yard structures
- bulk commodities

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs that are within the scope of license renewal and that are 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 structures and 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 structures. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, components and supporting structures for structures that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived SCs were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections, focusing on components that have not been identified as being 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 issued RAIs 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 with 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 issued RAIs to resolve any omissions or discrepancies identified.

2.4.1 Reactor/Auxiliary Building and Primary Containment

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 describes the reactor/auxiliary building and primary containment structures. The reactor building is a seismic Category I concrete structure designed to maintain its structural integrity during and following postulated DBAs. The purpose of the reactor building is to serve as primary containment during reactor refueling and maintenance operations when the primary containment is open and as a secondary containment barrier when the primary containment is functional. The substructures and exterior walls of the building, up to the refueling floor, consist of poured-in-place reinforced concrete, which provides tornado missile protection, above which is steel framed with insulated metal siding with sealed joints. The purpose of the auxiliary building is to support the SGTS exhaust stack located on the roof and to house major plant systems and components.

The reactor/auxiliary building houses the primary containment structure. The purpose of the primary containment is to provide a heat sink during a DBE and to limit the release of fission products in the event of a postulated DBA. The steel primary containment is a General Electric Mark I low-leakage pressure suppression containment design consisting of a drywell, torus, and connecting vent system.

The torus (or suppression chamber) is a leak-tight steel pressure vessel situated below and encircling the drywell. The vent system connects the drywell to the torus to conduct flow from the drywell to the torus.

The intended functions of the reactor/auxiliary building and primary containment system within the scope of license renewal include the following:

- to provide shelter, support, and protection for safety-related equipment and nonsafety-related equipment
- to support the Appendix R safe shutdown analysis, fire protection (10 CFR 50.48), ATWS (10 CFR 50.62), SBO (10 CFR 50.63), and EQ (10 CFR 50.49) requirements
- to provide radiation-shielding barriers to limit offsite radiation exposure
- to limit the release of radioactive materials and fission products
- to maintain the integrity of nonsafety-related structural components so that safety functions are not affected
- to provide heat sink for any postulated transient or accident condition in which the normal heat sink is unavailable
- to provide sufficient water to supply ECCS requirements and to refill the spent fuel pool if normal makeup water is not available

LRA Table 2.4-1, "Reactor/Auxiliary Building and Primary Containment Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1 and the applicable sections from the LRA and UFSAR, including the evaluation methodology described in Table 2.2-4 and Table 2.2-5 of LRA Section 2.0, using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Chapter 3 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structural component 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).

Structural commodities that are unique to the reactor/auxiliary building and primary containment are included in this review, whereas those that are common to in-scope systems and structures are reviewed in SER Section 2.4.4, "Bulk Commodities."

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted that UFSAR Section 3.4.4, "Flood Protection," and UFSAR Section 3.4.4.1, "Reactor Building Structure," discuss the use of watertight seals and water stops for flood protection of Category I structures.

However, a review of the tables in the LRA did not identify such components for in-scope structures as being credited for flood protection and subject to an AMR.

By letter dated September 26, 2014, the staff issued RAI 2.4-2 requesting the applicant to clarify the location within the LRA where they are addressed, the corresponding AMR and, if it was not included in the LRA, to justify its exclusion from the scope of license renewal pursuant to 10 CFR 54.4.

In its response letter dated October 24, 2014, to RAI 2.4-2, the applicant stated, in part, the following:

> Consistent with UFSAR Sections 3.4.4 and 3.4.4.1, watertight seals and water stops are credited for providing flood protection of Category I structures. Accordingly, they are included in the scope of license renewal. The watertight seals are elastomeric components used in doors and penetrations through the outside walls below the design flood elevation. They are included in LRA Table 3.5.2-4 line items "Penetration seals" and "Seals and gaskets (doors, manways and hatches)" with an intended function of flood barrier. The water stops are polymer components embedded in concrete at construction joints. They are inaccessible and protected from the environment by concrete (in the same manner as reinforcing steel). The water stops are treated as a subcomponent of reinforced concrete as is reinforcing steel. Therefore, water stops are not listed as a separate line item in an LRA table.

The staff finds the applicant's response acceptable because it verified the use of watertight seals and water stops for flood protection included within the scope of license renewal. The staff's concern described in RAI 2.4-2 is resolved.

The staff also noted that LRA Table 2.3.2-2, "Residual Heat Removal System," does not list expansion joint bellows as a component subject to an AMR. However, LRA Table 2.4-4 lists "compressible joints and seals" as a component subject to an AMR. By letter dated September 26, 2014, the staff issued RAI 2.4-1 requesting that the applicant confirm that this component includes the use of expansion joint bellows and, if they are installed in the RHR system, provide the locations where they are covered and whether they are subject to an AMR pursuant to 10 CFR 54.21(a)(1)(i).

In its response dated October 24, 2014, to RAI 2.4-1, the applicant stated, in part, the following:

> There are no bellows in the RHR system. [C]ontainment penetration bellows are considered part of the related structure rather than the process system. [I]nstead, the containment penetration bellows are described in LRA Section 2.4.1 and covered under the component type "penetration bellows" which is listed in LRA Table 2.4-1. The aging management review results for this component type are provided in LRA Table 3.5.2-1.

The licensee also stated the following:

> The bulk commodities listed in LRA Section 2.4.4 and shown in LRA Table 2.4-4 are those that are common to in-scope SSCs. Therefore, the entry in LRA Table 2.4-4 for "compressible joints and seals" is not related to the containment penetration bellows discussed above.

The staff finds the applicant's response acceptable because it confirmed that there are no bellows in the RHR system and because it clarified that containment penetration bellows are considered part of the related structure and are not part of the process system. The applicant also provided the LRA section and table that describe the containment penetration bellows and their AMR results. The staff's concern described in RAI 2.4-1 is resolved.

In addition, the staff noted that UFSAR Section 6.2.5.2.5, "Containment Purge," states that "debris screens have been provided for the purge valves inside the drywell to prevent debris from becoming entrained in the valves." However, LRA Section 2.4.1, "Reactor/Auxiliary Building and Primary Containment," does not discuss or include such a component in LRA Table 2.4-1. By letter dated September 26, 2014, the staff issued RAI 2.4-4 requesting the applicant to identify the section of the LRA where debris screens are covered, the applicable aging effects, and the AMP related to this component or to justify its exclusion from the scope of license renewal pursuant to 10 CFR 54.4.

In its response dated October 24, 2014, to RAI 2.4-4, the applicant stated, in part, the following:

> [D]ebris screens are provided for the purge valves inside the drywell to prevent debris from becoming entrained in the valves. There are two debris screens [identified as "strainer" component type] that are part of the Containment Atmospheric Control (CAC) system (T48) [as described in LRA Section 2.3.3.13].
>
> …The aging management evaluation is provided in LRA Table 3.3.2-13 under the "strainer" component type. As shown in LRA Table 3.3.2-13, strainers are stainless steel in an indoor air environment. Thus there is no aging effect requiring management. The material for the debris screens was determined to be stainless steel based on information from the vendor the screens may be either carbon or stainless steel supplemented by photographs of the screens showed a shiny surface indicative of stainless steel.
>
> However, as described in LRA Section 2.3.3.13, one drywell exhaust isolation valve of the CAC system is reviewed as part of the Standby Gas Treatment (SGT) system in LRA Section 2.3.2.7. One of the debris screens is located near this valve and was intended to be reviewed as part of the SGT system as indicated on drawing LRA-M-2709. The discussion in LRA Section 2.3.2.7 does not include the debris screen and no "strainer" component type is included in LRA Tables 2.3.2-7 and 3.2.2-7.

The applicant revised the LRA tables to include the "strainer" component type. The applicant also stated the following:

> Following the LRA revision, one of the debris screens will be addressed in the section and tables associated with the CAC system and the other will be addressed in the section and tables associated with the SGT system. This will ensure consistency with the LRA drawings. As described above, the debris screens are stainless steel in an indoor air environment such that there are no aging effects requiring a management and thus no impact on any aging management program.

The staff finds the applicant's response acceptable because it identified the LRA section where debris screens are covered and it confirmed that the debris screens are stainless steel in an indoor air environment, and, for this reason, there are no applicable aging effects requiring management. In addition, the applicant revised the LRA to ensure consistency with the LRA drawings. The staff's concern described in RAI 2.4-4 is resolved.

2.4.1.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the reactor/auxiliary building and primary containment components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the reactor/auxiliary building and primary containment components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2 Water-Cooled Structures

2.4.2.1 Summary of Technical Information in the Application

LRA Section 2.4.2 states that the water-control structures consist of the GSW pump house, RHR complex, and shore barrier.

The purpose of the GSW pump house is to prevent fire from damaging both fire protection pumps and to house the circulating water makeup pumps, GSW pumps, and associated electrical equipment. The structure consists of a metal-clad building founded on a reinforced concrete intake structure and concrete block interior walls. Traveling screens and stationary racks are provided to keep floating debris from entering the GSW intake pit.

The purpose of the RHR complex is to provide a source of cooling water for safe shutdown of the plant. The RHR complex, which is the ultimate heat sink, is a Category I structure and consists of the RHR service water system, the emergency equipment service water system, the DG service water system, the mechanical draft cooling towers, the emergency AC power system, and the reservoir. The RHR complex is a reinforced concrete and concrete block structure supported on a base mat.

The RHR complex includes a two-cell, mechanical-induced draft cooling tower constructed of Category I fireproof materials located over each division reservoir of the RHR complex. The complex also consists of two one-half capacity reinforced concrete Category I structures (reservoirs) founded on bedrock and connected to permit access to the combined inventory of water from the two reservoirs from either RHR division. Four EDGs are also part of the complex and are housed in separate rooms designed to withstand fire and missiles.

The shore barrier, a Category I structure consisting of a rubble-mound structure with an armor cover of stone, protects the shoreline adjacent to the plant from erosion resulting from wave action, preserves the integrity of the plant site fill placed to elevation 583 feet, and protects the main plant portion of the site against wave forces.

The intended functions of the water-control structures components within the scope of license renewal include the following:

- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements
- to provide physical support, shelter, and protection for safety-related SSCs

- to provide a source of cooling water for safe shutdown of the plant
- to provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1)

LRA Table 2.4-2, "Water-Control Structures Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2, the applicable sections from the LRA and UFSAR, and LRA Tables 2.2-4 and 2.2-5 using the evaluation methodology described in SER 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structural component 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).

Structural commodities that are unique to water-control structures are included in this review, whereas those that are common to in-scope systems and structures (e.g., anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits) are reviewed in SER Section 2.4.4.

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The staff noted that LRA Section 2.4.2, "Water-Control Structures," and UFSAR Section 9.2.1, "General Service Water System," state that "traveling screens and stationary racks are provided to keep floating debris from entering the GSW intake pit." However, such components are not included in LRA Table 2.4-2 or LRA Table 2.4-4. By letter dated September 26, 2014, the staff issued RAI 2.4-3 requesting the applicant to identify the section of the LRA where traveling screens and stationary racks are covered, the applicable aging effects, and the AMP related to these components. If they are not included in the LRA, the staff requested the applicant to justify their exclusion from the scope of license renewal. The staff also requested that the applicant clarify whether there are any additional trash racks, basket strainers, traveling screens, or any other debris prevention or removing mechanisms that are part of any in-scope structures subject to 10 CFR 54.4.

In its response dated October 24, 2014, to RAI 2.4-3, the applicant stated, in part, the following:

> The traveling screens and stationary racks (and any other debris prevention or removing mechanisms) are not considered part of the structure of the GSW pump house. These components are nonsafety-related and their failure could not impact any safety-related function since there is no safety-related equipment inside the GSW pump house. Therefore, the traveling screens and racks are not in-scope for license renewal. …For this reason, the components were not included in either LRA Tables 2.4-2 or 2.4-4.

The RHR complex and shore barrier are the other water-control structures addressed in LRA Section 2.4.2. There are no additional trash racks, basket strainers, traveling screens or other debris prevention or removal mechanisms that are part of these in-scope structures.

The staff finds the applicant's response acceptable because it justified the exclusion of traveling screens and stationary racks from the scope of license renewal. The applicant also clarified that there are no additional trash racks, basked trainers, traveling screens, or any other debris prevention or removing mechanisms that are part of any in-scope structures subject to 10 CFR 54.4. The staff's concern described in RAI 2.4-3 is resolved.

2.4.2.3 Conclusion

Based on its evaluation and on a review of the LRA, UFSAR, and RAI response, the staff concludes that the applicant has appropriately identified water-control structures components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the water-control structures components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.3 Turbine Building, Process Facilities, and Yard Structures

2.4.3.1 Summary of Technical Information in the Application

LRA Section 2.4.3 describes the turbine building, process facilities, and yard structures including the various structures within each category.

The turbine building houses the turbine generator, power conversion equipment, associated auxiliaries, and offsite power cables affecting CTG 11-1 and Division I and II cables associated with HPCI and RCIC. The turbine building is separate from the reactor/auxiliary building and is classified as a nonsafety-related structure.

The turbine building consists of reinforced concrete exterior walls, a superstructure that supports the turbine building cranes, and a concrete shield wall that surrounds the turbine generator. Interior walls are reinforced concrete or masonry block designed to provide radiation shielding and fire protection. The turbine pedestal is a reinforced concrete structure supported by a foundation that is separate and independent from the foundation mat of the turbine building.

The radwaste building is identified as a process facility. The purpose of the radwaste building is to house the liquid and solid waste processing equipment, offsite power cables affecting CTG 11-1, and RHR instrumentation equipment and cable. The building is structurally part of the turbine building and is constructed of reinforced concrete and concrete block and is equipped with Class A, B, and C fire doors. Penetrations through the walls of the turbine building are sealed to provide a 3-hour fire barrier.

The following structures are included within yard structures:

- CTG 11-1 structure
- condensate storage and return tanks foundations and retaining barrier
- CTG-11 FOST foundation
- independent spent fuel storage installation rail transfer pad

- manholes, handholes, and duct banks
- relay house and 120-kV switchyard
- relay house and 345-kV switchyard
- transformer and switchyard support structures and foundations

The CTG 11-1 provides AC electric power for distribution to the DTE grid to meet peak power demands and provides electric power as an alternate power source for Fermi 2 to cope with a SBO and to operate alternate safe shutdown equipment.

The purpose of the CST and CRT foundations and retaining barrier is to provide support for the CST/CRT, which provides a water source for standby feedwater, HPCI, CRD, RCIC, and core spray systems. Each tank foundation consists of a circular reinforced concrete foundation supported on consolidated structural backfill with all valves located in separate reinforced concrete valve pits at the base of each tank integral to their foundation. The tanks and foundations are located inside a 3-ft-high reinforced concrete wall dike area designed to collect the contents in the event of a tank spill or overflow and to prevent exposure to fire or heat from an exposure fire.

The CTG-11 FOST foundation provides support for the 800,000-gal FOST for the Fermi 1 combustion turbine units. The foundation is a nonsafety-related structure located approximately 1/3 mile from Fermi 2 and safety-related plant structures. The foundation consists of a circular reinforced concrete foundation supported on consolidated backfill.

The independent spent fuel storage installation rail transfer pad is a reinforced concrete roadway that provides for transfer of dry fuel casks and provides missile protection for the Division I and Division II safety-related duct banks located below the roadway.

Manholes, handholes, and duct banks allow underground routing of cables and certain piping. Manholes and handholes consist of reinforced concrete rectangular box structures buried underground with a reinforced concrete panel on top to allow access. Duct banks are used to route cables between structures and switchyard areas and comprise multiple raceways encased in concrete in an excavated trench backfilled with soil or engineered compacted backfill.

The 120-kV and 345-kV relay houses are nonsafety-related structures separated from safety-related SSCs so that its failure would not affect a safety function. The 120-kV relay house is a prefabricated metal building founded on a reinforced concrete foundation. The 345-kV relay house structure consists of unreinforced concrete block walls with a composite roof construction founded on a reinforced concrete foundation.

The purpose of the transformer and switchyard support structures and foundations is to provide structural support to SSCs that are relied on in safety analysis or plant evaluations to perform a function that supports SBO (10 CFR 50.63) requirements.

The intended functions of the turbine building, process facilities, and yard structures within the scope of license renewal include the following:

- to provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1)

- to maintain the integrity of nonsafety-related structural components so that safety functions are not affected
- to support fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) requirements
- to provide physical support, shelter, and protection for safety-related SSCs within the scope of license renewal

LRA Table 2.4-3, "Turbine Building, Process Facilities and Yard Structures Components Subject to Aging Management Review," identifies the component types that are within the scope of license renewal and that are subject to an AMR.

2.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4.3, the applicable sections from the LRA and UFSAR, and LRA Tables 2.2-4 and 2.2-5 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Chapter 3 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structural component 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).

Structural commodities that are unique to the turbine building, process facilities, and yard structures are included in this review, whereas those that are common to in-scope systems and structures (e.g., anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits) are reviewed in SER Section 2.4.4.

2.4.3.3 Conclusion

Based on its evaluation and on a review of the LRA and UFSAR, the staff concludes that the applicant has appropriately identified the turbine building, process facilities, and yard structure components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the turbine building, process facilities, and yard structure components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.4 Bulk Commodities

2.4.4.1 Summary of Technical Information in the Application

LRA Section 2.4.4, "Bulk Commodities," describes bulk commodities subject to an AMR as structural components or commodities that perform or support intended functions of SSCs within the scope of license renewal. The LRA also states that bulk commodities unique to a specific structure were included within individual structures' evaluations of LRA Sections 2.4.1, 2.4.2, and 2.4.3 and are not evaluated in this section (i.e., Section 2.4.4).

Bulk commodities evaluated in LRA Section 2.4.4 support both safety-related and nonsafety-related equipment during normal and accident conditions in the event of external events, such as tornadoes, earthquakes, floods and missiles, and internal events (e.g., pipe breaks and a LOCA).

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

- to provide support, shelter, and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal
- to maintain the integrity of nonsafety-related structural components so that safety functions are not affected
- to support safe-shutdown analysis, fire protection (10 CFR 50.48), EQ (10 CFR 50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) requirements

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

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4 and the applicable sections from the LRA using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has 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).

2.4.4.3 Conclusion

Based on its evaluation and review of the LRA and UFSAR, the staff concludes that the applicant has appropriately identified the bulk commodities components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the bulk commodities components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.5 Fire Barriers Portion of Bulk Commodities

2.4.5.1 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, 2.4.2, and 2.4.3. LRA Tables 2.4-1, 2.4-2, and 2.4-3 list all credited fire barrier types and license renewal intended functions.

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

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

- to maintain the integrity of nonsafety-related structural components so that safety functions are not affected
- to support safe shutdown analysis and fire protection (10 CFR 50.48) requirements

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4 (i.e., only the scoping and screening results of fire barriers) and the relevant LRA drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Sections 9.5.1 and 9A and the guidelines in Appendix A to BTP APCSB 9.5-1.

The staff also reviewed the following fire protection documents cited in the CLBs listed in the Fermi 2 Operating License Condition 2.C(9):

- NUREG-0798, Supplement 5, "Safety Evaluation Report Related to the Operation of Fermi 2," dated March 1985
- NUREG-0798, Supplement 6, "Safety Evaluation Report Related to the Operation of Fermi 2," dated July 1985

To perform its evaluation, the staff reviewed the applicable LRA sections and focused its review on fire barriers and components that had not been identified as being within the scope of license renewal.

The staff reviewed UFSAR Sections 9.5.1 and 9A for each structure 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 also verified that all intended functions delineated under 10 CFR 54.4(a) were specified in the LRA.

The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. By letter dated October 29, 2014, the staff issued RAI 2.4.4-1 stating that LRA Section 2.4.4 provides the scoping and screening results of various structural components that are within the scope of license renewal and that are subject to an AMR. LRA Table 2.4-4, includes fire barriers (e.g., doors; fire protection components and miscellaneous steel, including framing steel; penetration seals (end caps) and sleeves; manways, hatches, manhole covers, and hatch covers; structural fire barriers; wall, ceiling, floor slabs, curbs, and dikes; fire stops; fire wrap; and penetration seals). However, scoping and screening results do not provide the type of fire barriers present in various fire areas of the plant. The staff requested that the applicant provide a summary of the list of buildings or structures where fires barriers are credited and the specific types of barriers at these locations in Fermi 2 fire protection program.

In addition, the staff stated that LRA Table 2.4-4 does not include the following types of fire barriers or fire protection features:

- fire retardant coating for exposed structural steel
- solid metal cable tray covers
- radiant energy shields
- outdoor oil-filled transformer fire barriers

The staff requested that the applicant verify whether the fire barriers or fire protection features 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 excluded from 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 its response dated December 1, 2014, to RAI 2.4.4-1, the applicant provided a summary of the list of buildings or structures described in LRA Sections 2.4.1, 2.4.2, and 2.4.3 for which fire barriers are credited in the Fermi 2 fire protection program, as follows:

- LRA Section 2.4.1: reactor/auxiliary building
- LRA Section 2.4.2: GSW pump house and RHR complex
- LRA Section 2.4.3: turbine building, radwaste building, CST/CRT retaining barrier, manholes, handholes, and duct banks

Furthermore, the applicant provided specific types of fire barriers located at these locations in the Fermi 2 fire protection program, as follows:

- carbon steel railroad airlock doors and masonry walls in the reactor/auxiliary building as shown in LRA Section 2.4.1 and LRA Table 2.4-1
- masonry walls in the RHR complex and GSW pump house as shown in LRA Section 2.4.2 and LRA Table 2.4-2
- carbon steel roof decking or floor decking and masonry walls in the turbine building and radwaste building as shown in LRA Section 2.4.3 and LRA Table 2.4-3
- concrete manholes and hand holes as shown in LRA Section 2.4.3 and LRA Table 2.4-3
- concrete retaining barrier of the CST/CRT structure as shown in LRA Section 2.4.3 and LRA Table 2.4-3

The applicant stated the following:

> There are also other types of fire barriers that are common to the buildings or structures above but are not listed in the individual LRA Sections 2.4.1, 2.4.2, and 2.4.3. Consistent with application of bulk commodities described in LRA Section 2.4.4, these common fire barriers are considered bulk commodities and are included in LRA Section 2.4.4, "Bulk Commodities." They perform a fire barrier intended function and are shown in LRA Table 2.4-4.

In regard to the fire barrier features, the applicant responded to RAI 2.4.4-1 by stating the following:

> Fire retardant coatings, solid metal cable tray covers, radiant energy shields, and outdoor oil-filled transformer fire barriers are in the scope of Fermi 2 license renewal and are subject to aging management review (AMR). They are shown in the LRA tables as described below.
>
> Fire retardant coatings on exposed structural steel were not identified during preparation of the LRA and subsequent reviews have not identified fire retardant coatings being credited as a fire barrier for exposed structural steel. Fire

retardant coatings are generically included in LRA Table 2.4-4 under “Other Materials” as component type “Fire wrap” with an intended function of “Fire barrier.” The AMR results for the fire wrap components are provided in LRA Table 3.5.2-4. This ensures that any potential use of fire retardant coatings will be in scope and subject to aging management review.

“Solid metal cable tray covers” are included in LRA Table 2.4-4 under Steel and Other Metals as component type “Fire protection components – miscellaneous steel, including framing steel” with an intended function of “Fire barrier.” The material of the component is carbon steel and AMR results for the carbon steel components are provided in LRA Table 3.5.2-4.

“Radiant energy shields” are included in LRA Table 2.4-4 under Steel and Other Metals as component type “Fire protection components – miscellaneous steel, including framing steel” with an intended function of “Fire barrier.” The material of the component is carbon steel and AMR results for the carbon steel components are provided in LRA Table 3.5.2-4.

“Outdoor oil-filled transformer fire barriers” are included in LRA Table 2.4-4 under Concrete as component type “Structural fire barriers; walls, ceilings, floor slabs, curbs, dikes” with an intended function of “Fire barrier.” The material of the component is concrete and AMR results for this concrete component are provided in LRA Table 3.5.2-4.

The staff finds the applicant’s response to RAI 2.4.4-1 acceptable because it identified the types of fire barriers present in various fire areas of the plant and provided a list of buildings and structures where fires barriers are credited, including the specific types of barriers at these locations in the Fermi 2 Fire Protection Program. Furthermore, the applicant indicated that the following types of fire barriers are credited in the reactor/auxiliary building, GSW pump house, RHR complex, turbine building, radwaste building, CST/CRT retaining barrier, manholes, handholes, and duct banks: (1) masonry walls, (2) concrete retaining barrier of CST/CRT structure, (3) concrete manholes and handholes, (4) carbon steel railroad airlock doors, and (5) carbon steel roof decking or floor decking.

In addition, the applicant had addressed, in its response, the staff’s RAI concerning types of fire barriers or fire protection features. The applicant indicated that the fire retardant coatings on exposed structural steel were not credited as a fire barrier for exposed structural steel. The applicant also stated that LRA Table 2.4-4, under “Other Materials” and component type “Fire wrap,” included fire retardant coatings with an intended function of fire barrier. Further, the applicant indicated that the AMR results for the “Fire wrap” are provided in LRA Table 3.5.2-4; this ensures that any potential use of fire retardant coatings will be in scope and subject to an AMR.

The applicant indicated that the radiant energy shields are included in LRA Table 2.4-4 under “Steel and Other Metals” as component type “Fire protection components – miscellaneous steel, including framing steel,” with an intended function of fire barrier. The material of the component is carbon steel, and AMR results for the carbon steel components are provided in LRA Table 3.5.2-4. Fire barriers associated with the outdoor oil-filled transformer are included in LRA Table 2.4-4 under “Concrete” as component type “Structural fire barriers; walls, ceilings, floor slabs, curbs, dikes,” with an intended function of fire barrier. The material of the component is concrete, and AMR results for this concrete component are provided in LRA Table 3.5.2-4.

Based on its review, the staff finds the applicant's response to RAI 2.4.4-1 acceptable because it clarified 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 10 CFR 54.21(a)(1), respectively. The staff's concern described in RAI 2.4.4-1 is resolved.

By letter dated December 17, 2014, the staff issued RAI 2.4.4-2 stating that LRA Section 2.3.3.7, "Fire Protection – Water," indicates that fire dampers mounted in walls (for compliance with 10 CFR 50.48) are addressed in LRA Section 2.4.4; however, LRA Section 2.4.4 does not mention damper housings as a component type that is subject to an AMR. Similarly, LRA Section 2.4.2, "Water-Control Structures," Residual Heat Removal Complex subsection, also refers to fire dampers in walls; however, LRA Table 2.4-2 does not include any damper housings as a component type subject to an AMR. Table IX.B of the GALL Report defines "ducting and components" as including fire dampers. However, the SRP-LR and the GALL Report do not differentiate between air control or air flow dampers and fire dampers that are needed for compliance with 10 CFR 50.48.

Furthermore, the staff asked if all fire damper assemblies in fire barriers (walls, ceiling, and floors) have been appropriately identified as a component type as being within the scope of license renewal and subject to an AMR.

The staff requested that the applicant verify whether the fire damper assemblies mounted in fire barriers (i.e., not in HVAC ductwork) are within the scope of license renewal (e.g., in the RHR complex) 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.

By letters dated January 15, 2015, and April 10, 2015, the applicant responded to RAI 2.4.4-2 by stating the following:

> The fire damper assemblies mounted in fire barriers (walls, ceilings, and floors) outside of HVAC ductwork are within the scope of license renewal in accordance with10 CFR 54.4(a) and are subject to an AMR in accordance with 10 CFR 54.21(a)(1). The fire dampers perform an active function and are not subject to an AMR. The fire damper housings are passive long-lived components subject to an AMR. The fire damper housings are included with the component type "Fire protection components – miscellaneous steel including framing steel" with a fire barrier intended function as shown in LRA-Tables 2.4-4 and 3.5.2-4.

Based on its review, the staff finds the applicant's response to RAI 2.4.4-2 acceptable because it clarified that the fire damper assemblies mounted in fire barriers (walls, ceilings, and floors) outside of HVAC ductwork are within the scope of license renewal and are subject to an AMR (i.e., only the passive part of the fire damper assemblies (housings)). The staff confirmed that the fire damper housings are included in LRA Table 2.4-4 as being subject to an AMR in LRA Table 3.5.2-4. The staff's concern described in RAI 2.4.4-2 is resolved.

2.4.5.3 Conclusion

Based on its evaluation and review of the LRA, UFSAR Sections 9.5.1 and 9A, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the fire barrier commodities components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the fire barrier commodities components subject to an AMR, as required by 10 CFR 54.21(a)(1).

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

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

- electrical and I&C component 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, components and supporting structures for electrical and I&C systems that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections, focusing on components that have not been identified as being within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each electrical and I&C system to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a). 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 issued RAIs 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 with a change in configuration or properties or (2) the SSCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SSCs were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff issued RAIs to resolve any omissions or discrepancies identified.

2.5.1 Electrical and Instrumentation and Control Components and Commodity Groups

2.5.1.1 Summary of Technical Information in the Application

LRA Section 2.5 describes the electrical and I&C systems/components. Interface of these components with mechanical or civil/structural components and active electrical components with passive mechanical functions are covered in the mechanical or civil/structural sections. The bounding approach was the method used in determining the scope of the electrical and I&C systems in the license renewal. The scope includes all plant electrical and I&C components, including those electrical and I&C components in mechanical systems. The applicant stated, in part, that the bounding approach method eliminates the need for unique identification of individual components and specific component locations and precludes improper exclusion of components from the AMR. The scoping method includes identifying the electrical and I&C systems and their design functions and reviewing them against the criteria in 10 CFR 54.4.

The electrical and I&C components that were identified as being within the scope of license renewal have been grouped by the applicant into component commodity groups. The applicant has applied the screening criteria in 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii) to this list of component commodity groups to identify those that perform their intended functions without moving parts or without a change in configuration or properties and to remove the component commodity groups that are subject to replacement based on a qualified life or specified time period.

The following list identifies the component and commodity groups that are subject to an AMR and their intended functions:

- <u>Electrical Conductors</u>. The function of electrical conductors is to provide electrical continuity.

  - transmission conductors and connections
  - electrical/cable connections
  - fuse holders: metallic clamps
  - switchyard bus and connections
  - metal enclosed bus: bus/connections
  - metal enclosed bus: enclosure assemblies

- <u>Electrical Insulation</u>. The function of electrical insulation is to insulate and support electrical conductor.

  - conductor insulation for inaccessible power (400-V to 13.8-kV) cables (e.g., installed underground in conduit, in duct bank, or through direct burial) not subject to 10 CFR 50.49 EQ requirements
  - insulation material for electrical cables and connections (including terminal blocks and fuse holder) not subject to 10 CFR 50.49 EQ requirements
  - insulation material EIC penetration cables and connections not subject to 10 CFR 50.49 EQ requirements
  - insulation material for electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
  - high-voltage insulators (for SBO recovery)

- fuse holders: insulation material
- Metal Enclosed Bus: insulation, insulators

LRA Table 2.5-1, "Electrical and Instrumentation and Control Systems Components Subject to Aging Management Review," identifies electrical and I&C system component types that are within the scope of license renewal and are subject to an AMR.

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5 and UFSAR Sections 7 and 8 using the evaluation methodology described in SER Section 2.5 and the guidance in SRP-LR Section 2.5.

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).

General Design Criteria 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires that electric power from the transmission network to the onsite electric distribution system is supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure. In addition, the staff noted that the guidance provided by letter dated April 1, 2002, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))" (Agencywide Documents Access and Management System Accession No. ML020920464), states:

> For purposes of the license renewal rule, the staff has determined that the plant system portion of the offsite power system that is used to connect the plant to the offsite power source should be included within the scope of the rule. This path typically includes switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical system, and the associated control circuits and structures. Ensuring that the appropriate offsite power system long-lived passive SSCs that are part of this circuit path are subject to an AMR will assure that the bases underlying the SBO requirements are maintained over the period of extended license.

The applicant included the complete circuits between the onsite circuits and up to and including switchyard breakers (which includes the associated controls and structures) supplying the auxiliary transformer SS 65 and the auxiliary transformer SS 64 within the scope of license renewal. Both auxiliary transformers supply 4160-V and 480-V buses. The first source of offsite power is fed from the DTE electric/energy transmission and distribution system and received through three 345-kV circuit breakers (BM, CF, and DF), which supply the auxiliary transformer SS 65. These circuit breakers are the scoping boundary for the first source of offsite power. The second source of offsite power is fed from the DTE electric/energy transmission and distribution system and received through one 120 kV circuit breakers (A), which supply the auxiliary transformer SS 64. This circuit breaker is the scoping boundary for the second source of offsite power. Based on its review of the applicant's scoping analysis, the staff concludes that the scoping is consistent with the guidance provide by letter dated April 1, 2002, and later incorporated into SRP-LR Section 2.5.2.1.1.

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. By letter dated December 19, 2014, the staff issued RAI 2.5-1 requesting that the applicant verify whether the CTG 11-1 unit system electrical components are within the scope of the license renewal in accordance with 10 CFR 54.4(a)(3) and are subject to an AMR in accordance with 10 CFR 54.21(a)(1). In RAI 2.5-1, the staff also requested that the applicant provide a justification for exclusion if the CTG system electrical components are not within the scope of the license renewal. In its response to RAI 2.5-1, dated January 20, 2015, the applicant stated that the CTG 11-1 unit system electrical components are within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) and are subject to an AMR in accordance with 10 CFR 54.21(a)(1). The applicant also stated that the following passive commodities associated with SBO are subject to an AMR and are included in LRA Table 2.5-1:

- control circuit cables and connections (under the type "cable connections")
- high-voltage insulators
- medium-voltage cables and connections (under the type "cable connections")
- metal enclosed bus
- switchyard bus and connections

In its response to RAI 2.5-1, the applicant revised LRA Table 2.5-1 to clarify that the high-voltage insulators and switchyard bus and connections are included for SBO and for SBO recovery, and it provided the associated LRA markup.

The staff finds the applicant's response to RAI 2.5-1 acceptable because (1) the applicant clarified that the CTG 11-1 unit system electrical components, which provide alternate AC power during SBO, are within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) and are subject to an AMR in accordance with 10 CFR 54.21(a)(1) and (2) the applicant made changes to LRA Table 2.5-1 to clarify that high-voltage insulators and switchyard bus and connections are included for SBO and for SBO recovery. The staff's concern described in RAI 2.5-1 is resolved.

2.5.1.3 Conclusion

Based on its evaluation, the staff concludes that the applicant has 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 has adequately identified the electrical and I&C system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.6 Conclusion for Scoping and Screening

The staff reviewed the information in LRA Section 2, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results." The staff determines that the applicant's scoping and screening methodology was consistent with 10 CFR 54.21(a)(1) and the staff's positions on the treatment of safety-related and nonsafety-related SSCs within the scope of license renewal. The applicant's methodology on 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 made in order to comply with 10 CFR 54.21(a)(1), in accordance with the Atomic Energy Act of 1954, as amended, and in accordance with 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 Fermi 2 Nuclear Power Plant (Fermi 2) by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff).

In Appendix B to its license renewal application (LRA), DTE Electric Company (DTE or the applicant) described the 45 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, thereby 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:

- structures, systems, 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 performed its review 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 provided in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated December 2010; and the 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 September 15 and September 29, 2014, as described in the Audit Report entitled, "Aging Management Programs Audit Report Regarding the Fermi 2 Nuclear Power Plant," dated February 11, 2015. The onsite audits and reviews are designed to maximize the 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, resulting in a more efficient review.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that follows the standard LRA format agreed upon by the staff and the Nuclear Energy Institute (NEI) by letter dated April 7, 2003.

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 the 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 components within a system grouping (e.g., reactor coolant systems (RCSs), engineered safety features (ESFs), 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 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 AERMs. As part of the AMR process, the applicant determined any AERMs for each combination of material and environment.

(6) 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 number 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 are used in this LRA. 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 AMRs and AMPs:

(1) For items that the applicant stated are consistent with the GALL Report, the staff conducted either an audit or a technical review to determine consistency.

(2) For items that the applicant stated were consistent with the GALL Report with exceptions, enhancements, or both, the staff conducted either an audit or a technical review of the item to determine consistency. In addition, the staff conducted either an audit or a technical review of the applicant's technical justifications for the exceptions or the adequacy of the enhancements.

The SRP-LR states that an applicant may take one or more exceptions to specific GALL Report AMP elements; however, any 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.

These audits and technical reviews of the applicant's AMPs and AMRs determine whether the effects of aging on SCs can be adequately managed to maintain the intended functions consistent with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54.

3.0.2.1 Review of AMPs

For those AMPs for which the applicant had claimed consistency with the GALL Report AMPs, the staff conducted either an audit or a technical review to confirm that the applicant's AMPs were consistent with the GALL Report. For each AMP that had one or more deviations, the staff evaluated each deviation to determine whether the deviation was acceptable and whether the AMP, as modified, 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) "scope of program"—should include the specific SCs subject to a license renewal AMR.

(2) "preventive actions"—should prevent or mitigate aging degradation.

(3) "parameters monitored or inspected"—should be linked to the degradation of the particular structure or component intended function(s).

(4) "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 and one-time inspections to ensure timely detection of aging effects.

(5) "monitoring and trending"—should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) "acceptance criteria"—these criteria, against which the need for corrective actions 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"—these actions, including root cause determination and prevention of recurrence, should be timely.

(8) "confirmation process"—should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

(9) "administrative controls"—should provide for a formal review and approval process.

(10) "operating experience"—this 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 the AMP Audit Report and summarized 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 an assessment of the "corrective actions," "confirmation process," and "administrative controls" program elements.

The staff reviewed the information on the "operating experience" program element and documented its evaluation in SER Sections 3.0.3 and 3.0.5.

3.0.2.2 Review of AMR Results

Each LRA Table 2 contains information concerning whether the AMRs identified by the applicant align with the GALL Report AMRs. For a given AMR in a Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP combination for a particular system component type. Item numbers in column seven of the LRA, "NUREG-1801 Item," correlate to an AMR combination as identified in the GALL Report. A blank in column seven indicates that the applicant was unable to identify an appropriate correlation in the GALL Report. The staff also conducted a technical review of combinations not consistent with the GALL Report. The next column, "Table 1 Item," refers to a number indicating the correlating row in Table 1.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which it does not recommend further evaluation, the staff determined, on the basis of its review, whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP.

The staff audited these items to verify consistency with the GALL Report and to confirm 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 GALL Report AMP. The staff audited these items to verify consistency with the GALL Report and confirmed that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with that in the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these items to verify consistency with the GALL Report. The staff also determined whether the AMR item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

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

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect but credits a different AMP. The staff audited these items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

3.0.2.3 UFSAR Supplement

Consistent with the SRP-LR for the AMRs and AMPs that it reviewed, the staff also reviewed the updated final safety analysis report (UFSAR) supplement, which summarizes the applicant's programs and activities for managing aging effects for the period of extended operation, as required by 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff used the LRA, LRA supplements, the SRP-LR, the GALL Report, and requests 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 Fermi 2 Aging Management Programs

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Aboveground Metallic Tanks	A.1.1 B.1.1	New	Consistent	XI.M29, "Aboveground Metallic Tanks"	3.0.3.1.1 *(Consistent)*
Bolting Integrity	A.1.2 B.1.2	Existing	Consistent with Enhancements and Exception	XI.M18, "Bolting Integrity"	3.0.3.2.1 *(Consistent with Enhancements and Exceptions)*
Boraflex Monitoring	A.1.3 B.1.3	Existing	Consistent with Enhancement	XI.M22, "Boraflex Monitoring"	3.0.3.2.2 *(Deleted)*
Buried and Underground Piping	A.1.4 B.1.4	New	Consistent with Exception (exception added after initial LRA)	XI.M41, "Buried and Underground Piping and Tanks", as modified by LR-ISG-2015-01	3.0.3.1.2 *(Consistent with Exception)*
BWR CRD Return Line Nozzle	A.1.5 B.1.5	Existing	Consistent	XI.M6, "BWR Control Rod Drive Return Line Nozzle"	3.0.3.1.3 *(Consistent with an Enhancement)*
BWR Feedwater Nozzle	A.1.6 B.1.6	Existing	Consistent	XI.M5, "BWR Feedwater Nozzle"	3.0.3.1.4 *(Consistent with an Exception)*
BWR Penetrations	A.1.7 B.1.7	Existing	Consistent	XI.M8, "BWR Penetrations"	3.0.3.1.5 *(Consistent)*
BWR Stress Corrosion Cracking	A.1.8 B.1.8	Existing	Consistent	XI.M7, "BWR Stress Corrosion Cracking"	3.0.3.1.6 *(Consistent with an Exception)*
BWR Vessel ID Attachment Welds	A.1.9 B.1.9	Existing	Consistent	XI.M4, "BWR Vessel ID Attachment Welds"	3.0.3.1.7 *(Consistent)*
BWR Vessel Internals	A.1.10 B.1.10	Existing	Consistent with Enhancements	XI.M9, "BWR Vessels Internals"	3.0.3.2.3 *(Consistent with Enhancements)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Compressed Air Monitoring	A.1.11 B.1.11	Existing	Consistent with Enhancements and Exception	XI.M24, "Compressed Air Monitoring"	3.0.3.2.4 *(Consistent with Enhancements and an Exception)*
Containment Inservice Inspection – IWE	A.1.12 B.1.12	Existing	Consistent with Enhancements	XI.S1, "ASME Section XI, Subsection IWE"	3.0.3.2.5 *(Consistent with Enhancements)*
Containment Leak Rate	A.1.13 B.1.13	Existing	Consistent	XI.S4, "10 CFR Part 50, Appendix J"	3.0.3.1.8 *(Consistent)*
Diesel Fuel Monitoring	A.1.14 B.1.14	Existing	Consistent with Enhancements	XI.M30, "Fuel Oil Chemistry"	3.0.3.2.6 *(Consistent with Enhancements)*
Environmental Qualification (EQ) of Electric Components	A.1.15 B.1.15	Existing	Consistent	X.E1, "Environmental Qualification (EQ) of Electric Components"	3.0.3.1.9 *(Consistent)*
External Surfaces Monitoring	A.1.16 B.1.16	Existing	Consistent with Enhancements	XI.M36, "External Surfaces Monitoring of Mechanical Components"	3.0.3.2.7 *(Consistent with Enhancements)*
Fatigue Monitoring	A.1.17 B.1.17	Existing	Consistent with Enhancements and Exception	X.M1, "Fatigue Monitoring"	3.0.3.2.8 *(Consistent with Enhancements and an Exception)*
Fire Protection	A.1.18 B.1.18	Existing	Consistent with Enhancements	XI.M26, "Fire Protection"	3.0.3.2.9 *(Consistent with Enhancements)*
Fire Water System	A.1.19 B.1.19	Existing	Consistent with Enhancements	XI.M27, "Fire Water System"	3.0.3.2.10 *(Consistent with Enhancements and Exceptions)*
Flow-Accelerated Corrosion	A.1.20 B.1.20	Existing	Consistent with Enhancements	XI.M17, "Flow-Accelerated Corrosion"	3.0.3.2.11 *(Consistent with Enhancements)*
Inservice Inspection	A.1.21 B.1.21	Existing	Consistent	XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	3.0.3.1.10 *(Consistent)*
Inservice Inspection – IWF	A.1.22 B.1.22	Existing	Consistent with Enhancements	XI.S3, "ASME Section XI, Subsection IWF"	3.0.3.2.12 *(Consistent with Enhancements)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	A.1.23 B.1.23	Existing	Consistent with Enhancements	XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	3.0.3.2.13 *(Consistent with Enhancements)*
Internal Surfaces in Miscellaneous Piping and Ducting Components	A.1.24 B.1.24	New	Consistent	XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	3.0.3.1.11 *(Consistent)*
Masonry Wall	A.1.25 B.1.25	Existing	Consistent with Enhancements	XI.S5, "Masonry Walls"	3.0.3.2.14 *(Consistent with Enhancements)*
Metal Enclosed Bus Inspection	A.1.26 B.1.26	New	Consistent	XI.E4, "Metal Enclosed Bus"	3.0.3.1.12 *(Consistent)*
Neutron-Absorbing Material Monitoring	A.1.27 B.1.27	Existing	Consistent with Enhancements	XI.M40, "Monitoring of Neutron-Absorbing Materials Other than Boraflex"	3.0.3.2.15 *(Consistent with Enhancements)*
Non-EQ Cable Connections	A.1.28 B.1.28	New	Consistent	XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	3.0.3.1.13 *(Consistent)*
Non-EQ Inaccessible Power Cable (400 V to 13.8 kV)	A.1.29 B.1.29	New	Consistent	XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	3.0.3.1.14 *(Consistent)*
Non-EQ Instrumenta-tion Circuits Test Review	A.1.30 B.1.30	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"	3.0.3.1.15 *(Consistent)*
Non-EQ Insulated Cables and Connections	A.1.31 B.1.31	New	Consistent	XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	3.0.3.1.16 *(Consistent)*
Oil Analysis	A.1.32 B.1.32	Existing	Consistent with Enhancements	XI.M39, "Lubricating Oil Analysis"	3.0.3.2.16 *(Consistent with Enhancements)*
One-Time Inspection	A.1.33 B.1.33	New	Consistent	XI.M32, "One-Time Inspection"	3.0.3.1.17 *(Consistent)*
One-Time Inspection – Small-Bore Piping	A.1.34 B.1.34	New	Consistent	XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping"	3.0.3.1.18 *(Consistent)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Periodic Surveillance and Preventive Maintenance	A.1.35 B.1.35	Existing	Plant Specific with Enhancements	N/A	3.0.3.3.1 *(Plant Specific with Enhancements)*
Protective Coating Monitoring and Maintenance	A.1.36 B.1.36	Existing	Consistent with Enhancements	XI.S8, "Protective Coating Monitoring and Maintenance"	3.0.3.2.17 *(Consistent with Enhancements)*
Reactor Head Closure Studs	A.1.37 B.1.37	Existing	Consistent with Enhancements and Exceptions	XI.M3, "Reactor Head Closure Stud Bolting"	3.0.3.2.18 *(Consistent with Enhancements and Exceptions)*
Reactor Vessel Surveillance	A.1.38 B.1.38	Existing	Consistent with Enhancement and Exception	XI.M31, "Reactor Vessel Surveillance"	3.0.3.2.19 *(Consistent)*
RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	A.1.39 B.1.39	Existing	Consistent with Enhancements	XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants"	3.0.3.2.20 *(Consistent with Enhancements)*
Selective Leaching	A.1.40 B.1.40	New	Consistent	XI.M33, "Selective Leaching"	3.0.3.1.19 *(Consistent)*
Service Water Integrity	A.1.41 B.1.41	Existing	Consistent with Enhancements	XI.M20, "Open-Cycle Cooling Water System"	3.0.3.2.21 *(Consistent with Enhancements)*
Structures Monitoring	A.1.42 B.1.42	Existing	Consistent with Enhancements	XI.S6, "Structures Monitoring"	3.0.3.2.22 *(Consistent with Enhancements)*
Water Chemistry Control – BWR	A.1.43 B.1.43	Existing	Consistent	XI.M2, "Water Chemistry"	3.0.3.1.20 *(Consistent with an Exception)*
Water Chemistry Control – Closed Treated Water Systems	A.1.44 B.1.44	Existing	Consistent with Enhancements	XI.M21A, "Closed Treated Water Systems"	3.0.3.2.23 *(Consistent with Enhancements and an Exception)*
Coating Integrity	A.1.45 B.1.45	New	Consistent with Exceptions	XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	3.0.3.2.24 *(Consistent with Exceptions)*

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:

- Aboveground Metallic Tanks
- Buried and Underground Piping
- BWR Control Rod Drive Return Line Nozzle
- BWR Feedwater Nozzle
- BWR Penetrations
- BWR Stress Corrosion Cracking
- BWR Vessel ID Attachment Welds
- Containment Leak Rate
- Environmental Qualification (EQ) of Electric Components
- Inservice Inspection
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Metal Enclosed Bus Inspections
- Non-EQ Cable Connections
- Non-EQ Inaccessible Power Cable (400 V to 13.8 kV)
- Non-EQ Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections
- One-Time Inspection
- One-Time Inspection – Small-Bore Piping
- Selective Leaching
- Water Chemistry Control – BWR

3.0.3.1.1 Aboveground Metallic Tanks

Summary of Technical Information in the Application. LRA Section B.1.1, as amended by letter dated April 10, 2015, describes the new Aboveground Metallic Tanks Program as consistent with GALL Report AMP XI.M29, “Aboveground Metallic Tanks,” as modified by License Renewal Interim Staff Guidance (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 carbon steel and aluminum outdoor tanks constructed on soil or concrete to manage the aging effects of loss of material and cracking. The LRA also states that the AMP proposes to manage these aging effects through periodic visual; surface; and volumetric inspections of interior and exterior surfaces, including the tank tops, bottoms, and under insulation. The LRA further states that the tank inspections will be conducted in accordance with LR-ISG-2012-02 Table 4a, “Tank Inspection Recommendations,” and applicable Table 4a notes.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant’s program to the corresponding program elements of GALL Report AMP XI.M29.

For the “preventive actions” program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The “preventive actions” program element in GALL Report AMP XI.M29, as revised by LR-ISG-2012-02, recommends that sealant or caulking be applied to outdoor tanks at the external interface between the tank and concrete foundation unless the plant-specific configuration precludes the accumulation of water in this area. However, during its audit, the staff found that the applicant's Aboveground Metallic Tanks Program states that, "[i]n accordance with installation and design specifications, the tanks do not employ caulking or sealant at the concrete/tank interface." The staff also noted that the top surface of the concrete ring is not sloped to prevent water and moisture intrusion at the outside interface of the ring foundation. By letter dated December 17, 2014, the staff issued RAI B.1.1-1 requesting that the applicant state how the aging effects of loss of material and cracking of the aluminum in the proximity of the interface between the tank and concrete foundation will be managed for the condensate storage tank (CST) during the period of extended operation.

In its response dated January 20, 2015, the applicant stated that the insulation on the CST is expected to prevent the intrusion of water and moisture at the interface between the tank and concrete foundation because the insulation prevents access to the interface. LRA Sections A.1.1, B.1.1, and Commitment No. 3 were revised to perform a volumetric examination consisting of four 1-ft sections of the interface between the tank and concrete foundation before Fermi 2 enters the period of extended operation. The RAI response also stated that, although caulking was not included in the design and installation specifications for the CST, caulking appears to be present at some locations along the tank/concrete interface.

The staff noted that the response did not provide a basis for why the insulation is expected to prevent the access of water and moisture to the tank/concrete interface and prevent loss of material from occurring during the period of extended operation. By letter dated March 13, 2015, the staff issued RAI B.1.1-1a requesting that the applicant state the basis and justification for why the insulation on the CST will prevent water and moisture from having access to the tank/concrete interface and why it is an appropriate preventive action to manage loss of material.

In its response dated April 10, 2015, the applicant stated that neither the insulation nor caulking is credited as a moisture barrier. The response also stated that external inspections are not adequate to manage the aging effect of loss of material at the tank/concrete interface and removed the inspections added by letter dated January 20, 2015. LRA Sections A.1.1, B.1.1, and Commitment No. 3 were revised to include volumetric inspections in the proximity of the tank/concrete interface to manage loss of material. The inspections will be conducted from the inside of the tank and performed on a minimum of 25 percent of the interface. The inspection frequency is consistent with Table 4a in LR-ISG-2012-02. The inspections will be performed using a 2-inch grid or less, depending on the inspection technology used. These inspections are in addition to the tank bottom inspections already in Table 4a of LR-ISG-2012-02.

The response also states that the CST is fabricated from aluminum alloy 5454 and the aging effect of cracking due to stress corrosion cracking (SCC) does not need to be managed because the alloy is not susceptible to the aging effect. LRA Sections A.1.1 and B.1.1 are revised to remove cracking as an aging effect that needs to be managed for the CST.

The staff finds the applicant's response acceptable because loss of material at the tank/concrete interface is being managed by additional inspections. Direct inspection of the material in the proximity of the concrete/tank interface is an acceptable alternative to inspecting the caulk at the interface because the additional inspections are capable of detecting a loss of material in the area of interest. The staff's concern described in RAI B.1.1-1a is resolved.

The staff also finds the applicant's statement that the CST does not need to be managed for cracking due to SCC acceptable. The 5xxx series aluminum alloys are not susceptible to SCC unless the magnesium content is 3.5 weight percent or greater (1, 2). Aluminum alloy 5454 has a maximum magnesium content of 3.0 weight percent (3) and is not susceptible to cracking due to SCC. The staff referenced the following three documents to confirm that aluminum alloy 5454 is not susceptible to cracking due to SCC:

(1) B.F. Brown, "Stress-Corrosion Cracking in High Strength Steels and in Titanium and Aluminum Alloys," Naval Research Laboratory, 1972

(2) J.R. Davis, "Corrosion of Aluminum and Aluminum Alloys," ASM International, 1999

(3) American Society for Testing and Materials (ASTM) B209, "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate"

Based on its audit and review of the applicant's response to RAIs B.1.1-1 and B.1.1-1a, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M29, as revised by LR-ISG-2012-02.

Operating Experience. LRA Section B.1.1 summarizes operating experience related to the Aboveground Metallic Tanks Program. The LRA describes instances in which pitting and minor deficiencies were discovered in the carbon steel combustion turbine generator fuel oil tank during inspections conducted in 2000 and 2005. The LRA also describes instances in which deficiencies in flashing, insulation, screening, and painted surfaces were identified on the aluminum CST.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

The staff noted, during review of the past 10 years of plant-specific operating experience, that there have been multiple instances of degradation of the insulation and jacketing on the roof of the CST, including separations in the sheet metal seams, loss of flashing, and loss of insulation due to weather. In 2013, the CST roof insulation was completely removed and prefabricated insulation was installed. The as-found condition of the aluminum roof was not documented in the work order. The aluminum roof of the CST has been exposed to weather on multiple occasions, and it is unclear if there is any degradation under the prefabricated insulation. By letter dated December 17, 2014, the staff issued RAI B.1.1-2 requesting an assessment of the condition of the CST roof under the prefabricated insulation. Additionally, RAI B.1.1-2 requested that the applicant state the basis for why the proposed bare metal inspections of the CST roof will be sufficient to provide reasonable assurance that the CST will meet its CLB intended functions during the period of extended operation if the condition of the roof under the prefabricated insulation is unknown or degraded.

In its response dated January 20, 2015, the applicant stated that the roof of the CST was visually examined before installing the prefabricated insulation in 2013 and that no abnormalities were identified, although the examination was not documented.

The staff finds the applicant's response acceptable because visual examinations found that the condition of the roof was not degraded after being exposed to weather and because the CST will be inspected in accordance Table 4a in LR-ISG-2012-02.

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. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M29 was evaluated.

UFSAR Supplement. As amended by letter dated April 10, 2015, LRA Section A.1.1 provides the UFSAR supplement for the Aboveground Metallic Tanks AMP. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02, and noted that it contains a commitment (Commitment No. 3) to implement the program "[p]rior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025." The implementation schedule for the program is not consistent with LR-ISG-2012-02 Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems," which recommends that inspections commence in the 10-year period before the period of extended operation. The CLB for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information in its UFSAR supplement. By letter dated December 17, 2014, the staff issued RAI B.1.1-3 requesting that the applicant state the basis for why the implementation schedule for the Aboveground Metallic Tanks Program does not state that inspections will commence in the 10-year period before the period of extended operation.

In its response dated January 20, 2015, the applicant revised Commitment No. 3 in LRA Section A.4 to initiate inspections within the 10 years before the period of extended operation.

The staff finds the applicant's response acceptable because the implementation schedule is consistent with SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. Therefore, the UFSAR supplement for the Aboveground Metallic Tanks Program is consistent with the corresponding program description in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. The staff's concern described in RAI B.1.1-3 is resolved.

The staff finds that the information in the UFSAR supplement, as amended by letter dated April 10, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Aboveground Metallic Tanks Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Buried and Underground Piping

<u>Summary of Technical Information in the Application</u>. On February 4, 2016, the staff issued LR-ISG-2015-01, "Changes to Buried and Underground Piping and Tank Recommendations." By letter dated April 12, 2016, the applicant revised its Buried and Underground Piping Program to address the changes in LR-ISG-2015-01. As modified by letter dated April 12, 2016, LRA Section B.1.4 describes the new Buried and Underground Piping Program as consistent with GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," as modified by LR-ISG-2015-01 with one exception. The LRA states that the AMP addresses aluminum, carbon steel, gray cast iron, and stainless steel piping exposed to buried and underground 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 periodic excavated direct visual inspections and preventive actions, including coatings, backfill quality, and cathodic protection.

<u>Staff Evaluation</u>. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M41, as modified by LR-ISG-2011-03, "Generic Aging Lessons Learned (GALL) Report Revision 2 AMP XI.M41, 'Buried and Underground Piping and Tanks.'"

For the "detection of aging effects" and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "detection of aging effects" program element in GALL Report AMP XI.M41, as modified by LR-ISG-2011-03, recommends that the condition of coatings be evaluated in order to determine the number of inspections to be conducted for instances in which the cathodic protection system has not met availability or effectiveness goals. During its audit, the staff found that the applicant had classified the coatings on two excavated pipes as being in fair condition despite extensive holidays that exposed bare metal. Classifying the coatings as being in fair condition makes the conduct of fewer inspections than that recommended by the GALL Report possible. By letter dated December 17, 2014, the staff issued RAI B.1.4-1 requesting that the applicant state the basis for why it classified the condition of the coatings on these pipes as being in fair condition.

In its response dated January 15, 2015, the applicant stated that the classification of the coatings was related to existing inspections conducted under the scope of NEI 09-14, "Guideline for the Management of Underground Piping and Tank Integrity." The classification cited in the inspection reports was established based on a comparison of the level of degraded coatings to that assumed during the original design of the cathodic protection system. If the observed degradation would result in exceeding the design input value of bare metal for the cathodic protection system, the coatings would be classified as significantly degraded. The applicant also stated that, when the Buried and Underground Piping Program is implemented, the inspection category (i.e., Category C, E, or F) will be based on the criteria in LR-ISG-2011-03, as it relates to meeting the effectiveness of the cathodic protection system and the results of inspections (e.g., pipe wall loss). The staff noted that subsequent to the response to this RAI, the applicant revised its Buried and Underground Piping Program to be consistent with LR-ISG-2015-01.

The staff finds the applicant's response acceptable because when the Buried and Underground Piping Program is implemented, the applicant will use the criteria from LR-ISG-2015-01 to establish the inspection category, which ensures that an appropriate number of inspections are conducted to verify the condition of buried piping based on effectiveness of the cathodic protection system and existing inspection results. Additionally, the applicant stated that the coatings on the two excavated pipes that were classified as being in fair condition were using a classification system that differed from that in LR-ISG-2011-03, "Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program (AMP) XI.M41, 'Buried and Underground Piping and Tanks.'" The staff's concern described in RAI B.1.4-1 is resolved.

The "acceptance criteria" program element in GALL Report AMP XI.M41, as modified by LR-ISG-2011-03, recommends that, if a 100 millivolt (mV) polarization criterion is used in lieu of negative 0.85 volt (V) to assess the performance of the cathodic protection system, the LRA should include the basis for why adequate protection is provided for steel components exposed to a mixed potential environment. However, during its audit, the staff found that the acceptance criteria in the applicant's cathodic protection plant-specific procedure include negative 0.85 V and 100 mV of cathodic polarization. In addition, the procedure includes an acceptance criterion of less than 0.85 V in high-resistivity soils that are well drained and well aerated. The applicant did not provide the basis for these alternative acceptance criteria. By letter dated December 17, 2014, the staff issued RAI B.1.4-2 requesting that the applicant state the basis for the alternative acceptance criteria.

In its response dated January 15, 2015, the applicant stated that, "[i]f the new program, when developed, allows for the use of the -100 mV criterion for piping within the scope of the Buried and Underground Piping AMP, then the program will address why the effects of mixed potentials are minimal and why the most anodic metal in a system for which this criteria is used is adequately protected as required by Note 2 of Table 6a of GALL Report AMP XI.M41 as modified by LR-ISG-2011-03." The applicant also stated, in regard to the less than 0.85 V in high-resistivity soils that are well drained and well aerated, that when the program is implemented, the acceptance criteria will be consistent with Table 6a, "Cathodic Protection Acceptance Criteria."

The staff finds the applicant's response acceptable in part because the applicant stated that its acceptance criteria will be consistent with Table 6a and will not include the use of criterion less negative than 0.85 V. However, the applicant did not provide the basis for using the 100 mV cathodic polarization. Table 6a, Footnote 2, states that "applicants must explain in the application why the effects of mixed potentials are minimal and why the most anodic metal in the system is adequately protected." Because the applicant did not provide the basis for use of the 100 mV polarization criterion, the staff could not complete its evaluation of the "acceptance criteria" program element. By letter dated March 11, 2015, the staff issued RAI B.1.4-2a requesting that the applicant state the basis for why the effects of mixed potentials will be minimal and why the most anodic metal in the system will be adequately protected if this criterion is used.

In its response dated April 10, 2015, the applicant stated that as an alternative to the -850 mV polarized potential criterion, it will use either a minimum of 100 mV polarization or empirically verified criteria to demonstrate that the cathodic system has been providing effective protection. The use of the alternative acceptance criteria is based on the following actions:

- Uncoated electrical resistance probes (ERP) will be installed in the immediate vicinity of buried piping based on locations selected by a National Association of Corrosion Engineers (NACE)-qualified Cathodic Protection Specialist. Two probes will be installed: one connected to the cathodic protection system, and one installed without protection.

The probes will be constructed of the most anodic metal in the system. Permanent reference cells and reference metal will be installed near the piping that is being monitored.

- NACE International Publication 05107, “Report on Corrosion Probes in Soil or Concrete,” will be referenced during the application, installation, and use of ERPs. However, the specific details will be in accordance with vendor, manufacturer, and NACE-qualified Cathodic Protection Specialist recommendations. The specialist will evaluate the effects of site features (e.g., exposed large surface area tank bottoms, heavily congested areas of other buried piping, and very large diameter pipes). In areas in which these adjacent site features could affect the ERP data, cathodic protection effectiveness at the existing test point will not be evaluated by use of data from the ERPs. Soil sampling results (e.g., moisture content, pH (potential of hydrogen), and resistivity) will be considered for placement of ERPs.
- The corrosion rate of the ERP will be used to determine the effectiveness of the cathodic protection system in the areas being monitored. An acceptance criterion of 1 mil (0.001 inch) per year (1 mpy) will be established with a comparison of semi-annual measurements to the past year of measurements. If the corrosion rate exceeds 1 mpy in a given surveillance year, a remaining life calculation will be performed. If the measured corrosion rate is such that the component’s remaining life will exceed the life of the plant, it will be concluded that the cathodic protection system provided effective protection for that surveillance year. If the measured corrosion rate does not demonstrate that the component’s intended function will be met throughout the period of extended operation, it will be concluded that the cathodic protection system had not provided effective protection for that surveillance year and that the measurement will count against the effectiveness determination in accordance with LR-ISG-2011-03 Table 4a, “Inspections of Buried Pipe.”
- Service life calculations will be based on either the difference between (a) nominal wall thickness and minimum wall thickness or (b) measured wall thickness and minimum wall thickness. For piping segments without pre-existing minimum wall calculations, critical piping characteristics (e.g., piping specifications and design information) will be reviewed in order to compare the characteristics to piping that have been analyzed. If the calculations or comparison do not demonstrate that the buried in-scope piping will remain functional after a loss of 60 mils and after the material loss of 12.5 percent of the nominal wall thickness, the allowable corrosion rate will be adjusted.
- An acceptance criterion of no higher than -1,200 mV pipe-to-soil potential will be established to limit potential coating damage.

As amended by letter dated April 12, 2016, the applicant revised LRA Sections A.1.4 and B.1.4 to state that “[w]hen using the 100 mV, -750 mV or -650 mV polarization criteria as an alternative to the -850 mV criterion, for steel piping, electric resistance probes” will be used. In its response dated April 10, 2015, the applicant also stated that (a) ERPs will be installed in locations determined by a NACE-qualified Cathodic Protection Specialist, (b) the ERPs will be made of the most anodic metal in the system, (c) permanent reference cells and reference metal will be installed, (d) the ERPs will be uncoated and placed in the immediate vicinity of the buried piping that it is representing, and (e) two probes will be installed in each location with one connected to the cathodic protection system and with the other left unprotected.

The staff noted the following:

- Based on a review of NACE International Publication 05107, ERPs are capable of measuring corrosion rates of the probe by correlating increases in electrical resistance to a loss of material of the probe. The rate of corrosion of the probe provides a direct indication of the effectiveness of the cathodic protection system in the vicinity of the probe.
- NACE International Publication 05107 provides guidance on the installation and use of ERPs, including material type, size of probe, soil contact, proximity to the piping that it is representing, circuit configurations, corrosion rate calculation formulas, and acceptance criteria. Use of the guidance in this publication in conjunction with vendor, manufacturer, and NACE-qualified cathodic protection expert recommendations can result in effectively determining the corrosion rate of buried components.
- The 1 mpy acceptance criterion is consistent with NACE International Publication 05107. The twofold acceptance criterion (i.e., 1 mpy and remaining life calculation) is sufficient to determine that either local cathodic protection is effective or ineffective and, therefore, provides reasonable assurance that a buried in-scope component will be capable of meeting its intended function.
- NACE offers four levels of qualification consisting of cathodic protection tester, cathodic protection technician, cathodic protection technologist, and cathodic protection specialist (NACE Courses CP1 through CP4). The staff noted that the NACE website at http://www.naceinstitute.org/Certification/ (accessed March 19, 2015) states that the NACE CP4 Cathodic Protection Specialist is "geared toward those persons involved in the design, installation, and maintenance of cathodic protection systems."
- The upper -1,200 mV is consistent with LR-ISG-2011-03 Table 6a.

The staff finds the applicant's proposal to use ERPs to assess the effectiveness of localized adequacy of cathodic protection and its response to RAI B.1.4-2 and RAI B.1.4-2a acceptable for the following reasons:

- ERPs are capable of providing localized corrosion rates that can be assessed against an acceptance criterion in order to demonstrate the effectiveness of a cathodic protection system.
- Soil corrosion data will be factored into the placement of ERPs to ensure that the probe data are not misleading due to potential soil impacts on corrosion rates.
- The applicant identified appropriate factors to consider for site structural impacts (e.g., exposed large surface area tank bottoms, heavily congested areas of other buried piping, and very large diameter pipes).
- An acceptance criterion of 1 mpy is an industry-accepted value, and the applicant will verify that the associated piping has sufficient margin to allow this rate of corrosion, or the allowed corrosion rate will be adjusted.
- NACE International Publication 05107 provides appropriate guidance on the installation and use of ERPs.
- Personnel who provide input for the location of ERP and who use soil corrosion probe data will be appropriately qualified.

- The use of soil corrosion probes as an alternative to the -850 mV polarization criterion for cathodic protection is consistent with the "acceptance criteria" program element of GALL Report AMP XI.M41, as modified by LR-ISG-2015-01.

The staff's concern described in RAI B.1.4-2 and RAI B.1.4-2a is resolved.

As amended by letter dated April 12, 2016, the applicant stated an exception to the "preventive actions" program element of GALL Report AMP XI.M41, as modified by LR-ISG-2015-01. The applicant stated that (a) there are two underground stainless steel pipes between the CST vault and the turbine building that may not have been coated, (b) the buried portion outside of the vault might not be coated, (c) "an inspection will be performed of both of these stainless steel pipes that are routed between the CST and the Turbine Building every 10 years, commencing in the 10 years prior to the period of extended operation," (d) "[i]f during the first inspection, the stainless steel piping is determined to be coated, then future inspection will be at a rate of one inspection per 10-year interval, consistent with Table XI.M41-2," and (e) the groundwater monitoring program provides additional means of monitoring for degradation of piping in this area.

The staff noted that Table XI.M41-1, "Preventive Actions for Buried and Underground Piping and Tanks," recommends that buried stainless steel piping be coated. Table XI.M41-2, "Inspection of Buried and Underground Piping and Tanks," recommends that one inspection be conducted in each 10-year period for buried stainless steel piping. The staff finds the exception acceptable because the applicant will double the number of visual inspections of the subject buried piping in each 10-year interval. The extra inspections and the groundwater monitoring could be sufficient to detect any through-wall pitting or crevice corrosion or cracking before a loss of intended function.

Based on its audit; review of the applicant's responses to RAIs B.1.4-1, B.1.4-2, and RAI B.1.4-2a; and the applicant's changes to its program submitted by letter dated April 12, 2016, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M41, as modified by LR-ISG-2015-01. The staff also reviewed the exception associated with the "preventive actions" program element, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.4 summarizes operating experience related to the Buried and Underground Piping Program. The LRA describes instances in which inspections and soil sampling were used to determine the condition of buried piping.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M41, as modified by LR-ISG-2011-03, was evaluated.

UFSAR Supplement. As amended by letter dated May 9, 2016, LRA Section A.1.4 provides the UFSAR supplement for the Buried and Underground Piping Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as modified by LR-ISG-2015-01.

The staff had noted that the applicant committed (Commitment No. 6) to implement the new Buried and Underground Piping Program "[p]rior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later" for managing the effects of aging for applicable components. However, GALL Report AMP XI.M41, as modified by LR-ISG-2011-03, recommends that inspections should commence in the 10-year period before the period of extended operation. By letter dated December 17, 2014, the staff issued RAI B.1.4-3 requesting that the applicant state the basis for why the implementation schedule for the Buried and Underground Piping Program does not state that inspections will commence in the 10-year period before the period of extended operation.

In its response dated January 15, 2015, the applicant revised Commitment No. 6 to state that it will conduct initial inspections and soil testing (if testing is used to reduce the number of inspections) in the 10-year period before March 20, 2025.

The staff finds the applicant's response acceptable because the Buried and Underground Piping Program will be implemented in the 10-year period before the period of extended operation, as recommended in LR-ISG-2011-03 and LR-ISG-2015-01. The staff's concern described in RAI B.1.4-3 is resolved.

The staff finds that the information in the UFSAR supplement, as amended by letter dated May 9, 2016, is an adequate summary description of the program.

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

3.0.3.1.3 BWR CRD Return Line Nozzle

Summary of Technical Information in the Application. LRA Section B.1.5, as revised by letter dated May 19, 2015, describes the existing BWR CRD Return Line Nozzle Program as consistent, with an enhancement, with GALL Report AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The LRA states that the program manages cracking of the control rod drive (CRD) return line nozzle through preventive measures and inservice inspection (ISI) activities that are in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, Table IWB-2500-1, and the applicant's existing commitments to implement recommendations from NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," dated November 1980. The LRA also states that the CRD return line nozzle was capped before plant 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.M6.

The staff also reviewed the portions of the "detection of aging effects" program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement. LRA Section B.1.5 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that procedures, as necessary, would be revised to ensure that ultrasonic testing (UT) would be used to ensure the detection of applicable aging effects. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M6 and finds it acceptable because, when implemented, it will make the applicant's AMP consistent with the guidance provided in the GALL Report AMP. The staff noted that the "detection of aging effects" program element of GALL Report AMP XI.M6 states that the extent and schedule of inspections should be such that the effects of cracking are detected before loss of 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.M6. The staff also 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 effect.

Operating Experience. LRA Section B.1.5 summarizes operating experience related to the BWR CRD Return Line Nozzle Program. The LRA states that the applicant inspected the CRD return line nozzle in 2003 and 2012 with satisfactory results. These inspections involved an ultrasonic examination of the nozzle-to-shell and nozzle-to-cap welds with a visual examination of the nozzle inner radius. The LRA also states that, through a self-assessment, the applicant found that the 2012 nozzle inner radius examination did not completely fulfill the necessary coverage requirements. As a result, the applicant revised the procedure to provide better guidance and planned to perform the examination again during an upcoming refueling outage (RFO).

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M6 was evaluated.

UFSAR Supplement. LRA Section A.1.5, as revised by letter dated May 19, 2015, provides the UFSAR supplement for the BWR CRD Return Line Nozzle Program. The staff reviewed this

UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to revise its program procedures to perform ultrasonic examinations, as necessary, before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR CRD Return Line Nozzle Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancement and confirmed that its implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 BWR Feedwater Nozzle

Summary of Technical Information in the Application. LRA Section B.1.6, as revised by letter dated May 19, 2015, describes the existing BWR Feedwater Nozzle Program as consistent, with an exception, with GALL Report AMP XI.M5, "BWR Feedwater Nozzle." The LRA states that the program manages cracking due to cyclic loading of the reactor vessel feedwater nozzles. The program manages this aging effect through periodic inspections of certain critical regions of the feedwater nozzles. The LRA states that these inspection activities follow the recommendations and inspection schedule from General Electric (GE)-NE-523-A71-0594-A, Revision 1, "Alternate BWR Feedwater Nozzle Inspection Requirements," dated May 2000, and NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," dated November 1980. According to the LRA, the inspections conducted under the BWR Feedwater Nozzle Program augment those inspections specified by ASME Code Section XI. The LRA also states that the feedwater nozzles at Fermi 2 were never cladded and that they use an improved triple-sleeve sparger design.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M5.

The staff also reviewed the portions of the "detection of aging effects" program element associated with the exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.1.6 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that the inspection schedule in the GALL Report is in accordance with Table 6-1 of GE-NE-523-A71-0594-A, Revision 1. GE-NE-523-A71-0594-A, Revision 1, states that the examination schedule specified in Table 6-1 is applicable until such time that 10 CFR 50.55a, "Codes and Standards," is revised to require implementation of ASME Code Section XI, Appendix VIII. The applicant stated that the inspection frequency in its program is based on ASME Code Section XI rather than Table 6-1 of GE-NE-523-A71-0594-A, Revision 1; therefore, it identifies it as a program exception. The staff reviewed this exception and noted that the inspection frequency referred to in the applicant's program is based on ASME Code Section XI and will provide an acceptable level of quality and safety by using more stringent qualification and acceptance criteria. The staff also noted that the "detection of aging effects" program element of GALL Report AMP XI.M5 states that the extent and schedule of the inspection prescribed by the program are designed to ensure that aging effects are discovered and repaired before the loss of intended function of the component. The staff further noted that the inspection frequency, as implemented, ensures that aging effects will be adequately managed before the loss of intended function of the component. Therefore, the staff finds the exception acceptable.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M5.

Operating Experience. LRA Section B.1.6 summarizes operating experience related to the BWR Feedwater Nozzle Program. The LRA states that three of the six feedwater nozzles were subject to manual, ultrasonic examinations of the nozzle inner radius and bore each RFO. In 2000, the LRA states that the applicant began to use a qualified and automated ultrasonic technique to assess the integrity of the feedwater nozzle inner radius and bore in accordance with GE-NE-523-A71-0594-A, Revision 1. The LRA states that no indications of cracking have been discovered in the feedwater nozzles, and no recordable indications have been identified from past inspections of the feedwater spargers.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M5 was evaluated.

UFSAR Supplement. LRA Section A.1.6 provides the UFSAR supplement for the BWR Feedwater Nozzle Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Feedwater Nozzle Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 BWR Penetrations

Summary of Technical Information in the Application. LRA Section B.1.7 describes the existing BWR Penetrations Program as consistent with GALL Report AMP XI.M8, "BWR Penetrations." The LRA states that the program manages cracking due to cyclic loading and SCC and intergranular stress corrosion cracking (IGSCC) of BWR instrument penetrations, CRD housing and incore housing penetrations, standby liquid control (SLC) nozzles, and core plate differential pressure nozzles. The LRA also states that the program manages cracking through periodic inspections of certain critical regions of the penetrations and nozzles. These inspection activities follow the recommendations and inspection schedule in BWRVIP-49-A, "BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines," dated March 2002; BWRVIP-47-A, "BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines," dated June 2004; BWRVIP-27-A, "BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines," dated August 2003; and the requirements in 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.M8. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M8.

Operating Experience. LRA Section B.1.7 summarizes operating experience related to the BWR Penetrations Program. The LRA states that VT-2 inspections of the instrumentation nozzles were performed in 2003, and no failures were identified. The LRA also summarizes the baseline inspections of the CRD housing that were performed in accordance with the guidance in BWRVIP-47-A. The LRA states that all of the recommended inspections were completed by the end of Refueling Outage No. 14. No indications of cracking were identified; however, a manufacturing discontinuity was found on one weld. This condition was evaluated and accepted in accordance with ASME Code Section XI.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M8 was evaluated.

UFSAR Supplement. LRA Section A.1.7 provides the UFSAR supplement for the BWR Penetrations Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Penetrations Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 BWR Stress Corrosion Cracking

Summary of Technical Information in the Application. LRA Section B.1.8 describes the existing BWR Stress Corrosion Cracking Program as consistent with GALL Report AMP XI.M7, "BWR Stress Corrosion Cracking." The program manages IGSCC in nickel alloy, stainless steel, and cast austenitic stainless steel (CASS) reactor coolant pressure boundary piping and piping welds that are 4 inches or larger in nominal diameter containing reactor coolant at a temperature above 200 degrees Fahrenheit (°F) during power operation regardless of code classification. This program performs scheduled volumetric examinations that provide timely detection of IGSCC and leakage of coolant in accordance with the methods, inspection guidelines, and flaw evaluation criteria described in the ASME Code; NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," dated January 1988; NRC Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," dated January 25, 1988, and its Supplement 1; NRC-approved BWRVIP-75-A, "BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," dated October 2005; and other requirements in 10 CFR 50.55a with NRC-approved alternatives.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M7. For the "detection of aging effect" program element, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

GALL Report AMP XI.M7, "BWR Stress Corrosion Cracking," states that the comprehensive program to manage IGSCC in BWR coolant pressure boundary piping is outlined in NUREG-0313, Revision 2, and GL 88-01 with its Supplement 1. The "detection of aging effects" program element of GALL Report AMP XI.M7 also states that modifications of the extent and schedule of inspection in GL 88-01 are allowed in accordance with the inspection guidance in staff-approved BWRVIP-75-A. LRA Section B.1.8 states that the applicant's BWR Stress Corrosion Cracking Program is consistent with GALL Report AMP XI.M7.

During the audit, the staff noted that the applicant implemented risk-informed ISI for the current (third) inservice inspection interval. The staff also noted that GL 88-01 Category A welds (i.e., IGSCC-resistant welds) are subsumed in the applicant's risk-informed ISI. The staff further noted that the LRA and onsite program evaluation report do not describe what percentage of the Category A welds are inspected by the applicant's program. It was not clear to the staff whether the percentage of Category A welds, which the applicant's program inspects, is consistent with the guidance described in GL 88-01 and BWRVIP-75-A.

By letter dated December 4, 2014, the staff issued RAI B.1.8-1 requesting that the applicant provide the percentage of Category A welds that the program will inspect during the period of extended operation. The staff also requested that, if the extent of the inspection for Category A welds is different from the guidance in GL 88-01 and BWRVIP-75-A, the applicant justify why the program is adequate to manage the aging effect of IGSCC for the Category A welds.

In its response dated January 5, 2015, the applicant indicated that its program inspects 10 percent of the GL 88-01 Category A welds, consistent with the inspection guidelines in BWRVIP-75-A for the welds protected by hydrogen water chemistry. The applicant also clarified that it has 38 Category A welds and 4 of those welds are inspected during each ISI interval to meet the inspection extent (i.e., 10 percent). The applicant further clarified that two welds are inspected during the first inspection period, and one weld is inspected in each of the following two periods of the 10-year ISI interval. The applicant stated that the inspection schedule is consistent with the guidance in BWRVIP-75-A Section 3.1.1 and that 50 percent of the selected welds should be examined during the first 6 years of the ISI interval.

The staff finds the applicant’s response acceptable because the applicant clarified that the inspection extent and schedule for Category A welds are consistent with the guidance in BWRVIP-75-A. In addition, the staff noted that the applicant’s operating experience indicates the absence of IGSCC in the piping and piping welds within the scope of the program, as described below. The plant-specific operating experience also supports the adequacy of the applicant’s inspection extent and schedule for IGSCC-resistant Category A welds. The staff’s concern described in RAI B.1.8-1 is resolved.

In its review of the applicant’s program and related information, the staff noted that the following references indicate that the applicant’s condensate and feedwater systems include 24 Category D welds in accordance with GL 88-01 (i.e., welds with materials nonresistant to IGSCC with no stress improvement process):

- Letter dated July 29, 1992, from the Detroit Edison Company to the NRC (NRC-92-0090), Subject: Fermi 2 Response to GL 88-01, Supplement 1, NRC Position on Intergranular Stress-Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping
- Letter dated December 18, 1992, from the NRC to the Detroit Edison Company, Subject: Fermi-2 Removal of 24 Condensate and Feedwater System Welds from the Inservice Inspection Nondestructive Examination (ISI-NDE) Program (TAC No. M84177)

The staff also noted that the following LRA tables describe the applicant’s AMR items for the condensate and feedwater systems:

- Table 3.4.2-3-2, “Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems”
- Table 3.4.2-2, “Feedwater and Standby Feedwater System”
- Table 3.4.2-3-3, “Feedwater and Standby Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems”

The AMR tables for the condensate and feedwater systems in the LRA do not include AMR items to manage IGSCC for the Category D welds that were identified in the 1992 communications between the Detroit Edison Company and the NRC. Therefore, the staff could not determine the adequacy of the applicant’s program and AMR results without additional information to justify the omission of relevant AMR items.

In addition, the staff noted that the 1992 communications indicate that these Category D welds are located outboard of the containment isolation valves and that at least 10 percent of these welds should be inspected during each RFO as part of the applicant's ISI. The staff also noted that the extent and frequency of the application's inspections are different from the inspection guidance in GL 88-01 and BWRVIP-75-A. For example, BWRVIP-75-A states that, in the case of the implementation of hydrogen water chemistry, 100 percent of Category D welds should be inspected every 10 years and that at least 50 percent of these welds should be inspected in the first 6 years.

By letter dated December 4, 2014, the staff issued RAI B.1.8-2 requesting that the applicant clarify whether the condensate and feedwater systems include GL 88-01 Category D welds. The staff also requested that the applicant provide adequate justification for why the LRA AMR tables for the condensate and feedwater systems do not include AMR items to manage IGSCC for the Category D welds. The staff further requested that the applicant clarify why the LRA does not identify the inspection extent and frequency for Category D welds as a program exception to GALL Report AMP XI.M7. In addition, the staff requested that the applicant provide technical justification for why the inspection extent and frequency for Category D welds are acceptable for adequate aging management. The staff requested that, as part of the response, the applicant discuss whether the plant-specific operating experience, including inspection results, justifies the adequacy of aging management for Category D welds.

In its response dated January 5, 2015, the applicant summarized the 1992 communications between the Detroit Edison Company and the NRC by stating that:

> In letter NRC-92-0090 dated July 29, 1992, Fermi 2 proposed deleting the 24 Category D welds since they do not contain reactor coolant as defined in NRC regulations, and the welds were not likely susceptible to IGSCC based on the operating environment. The NRC did not completely agree with that position because the water was the same water that would enter the reactor pressure vessel (RPV). Instead, in the response dated December 18, 1992 (TAC No. M84177) the NRC stated, "These welds may be susceptible to IGSCC. Therefore, the 24 welds should not be removed from the Fermi-2 ISI-NDE Program." The correspondence also stated, "the staff has determined that the same staff position delineated in GL 88-01, Supplement 1 for reactor water cleanup (RWCU) piping outboard of the containment isolation valves should be applied to those 24 welds." GL 88-01, Supplement 1 was issued to discuss some unnecessary hardships created by GL 88-01. One specific hardship was inspection of susceptible nonsafety-related piping outside the containment isolation valves. Therefore, the NRC correspondence concluded that the staff determined that "an inspection of the subject piping on a sampling basis of at least 10 percent of the weld population should be performed during each refueling outage."

As discussed above, the applicant clarified that the condensate and feedwater systems include Category D welds and that these welds are located outside the containment isolation valves. In its response, the applicant revised LRA Table 3.4.2-2 for the feedwater system and Table 3.4.2-3-2 for the condensate system to include AMR items for the Category D welds, consistent with the 1992 communications. The AMR items that have been added confirm that the BWR Stress Corrosion Cracking Program is used to manage IGSCC for the Category D welds.

The applicant clarified that the extent and frequency of these inspections are based on the NRC determination that 10 percent of these Category D welds should be inspected each outage as specified in the NRC letter dated December 18, 1992. The applicant also indicated that, because the inspection guidance in GL 88-01, Supplement 1, for the RWCU system was applied to other systems (i.e., feedwater and condensate systems at Fermi 2), LRA Sections A.1.8 (UFSAR supplement) and B.1.8 (program description) are revised to state that this is a program exception. The applicant further clarified that, because no IGSCC has been observed from these Category D welds in the inspections performed to date, the operating experience supports that cracking due to IGSCC in feedwater and condensate piping will be adequately managed.

The staff found the applicant's response, including the program exception, acceptable because (1) the applicant adequately revised the LRA to include AMR items for the Category D welds, (2) the applicant clarified that the inspection extent and frequency for the feedwater and condensate piping welds are consistent with the CLB that are based on the guidance in NRC GL 88-01, Supplement 1, and the staff's determination, and (3) the applicant's operating experience, including inspection results, confirms that no IGSCC has been observed in these welds. The staff's concern described in RAI B.1.8-2 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.1.8-1 and B.1.8-2, 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.M7.

Exception. In its response to RAI B.1.8-2, dated January 5, 2015, the applicant provided a revision to LRA Section B.1.8 to identify an exception to the "detection of aging effects" and "monitoring and trending" program elements. In this exception, the applicant indicated that the inspection extent and frequency for Category D welds in the feedwater and condensate systems are 10 percent each RFO.

As previously discussed, the staff noted that the applicant identified this exception because the inspection extent and frequency are based on the guidance in GL 88-01, Supplement 1, which addresses the inspections of RWCU piping outside containment isolation valves. The staff finds the exception acceptable because (1) the applicant's Category D welds in the feedwater and condensate systems are located outside the containment isolation valves, consistent with the RWCU piping that is addressed in GL 88-01, Supplement 1; (2) the inspection extent and frequency are also consistent with the CLB that are based on the staff's determination (as described in the NRC letter dated December 18, 1992); and (3) the applicant's operating experience confirms that no IGSCC has been observed in these welds.

Operating Experience. LRA Section B.1.8 summarizes the operating experience related to the BWR Stress Corrosion Cracking Program. The LRA states that no plant-specific AMP issues have been identified for the applicant's facility. The LRA also states that it uses online noble metal chemistry to mitigate SCC. The LRA further indicates that the use of proven methods for inspections and water chemistry control provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions, consistent with the CLB through the period of extended operation.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its AMP audit and review, the staff identified operating experience for which it determined the need for additional clarification and the issuance of an RAI, as discussed below.

The staff noted that the applicant's Condition Assessment Resolution Document (CARD) 13-23127 addresses the Institute of Nuclear Power Operations Event Report (IER) 13-17, "Main Condenser Cooling Water Inleakage." The staff also noted that CARD 13-23127 states that, since January 2011, events have been reported in which condenser cooling water inleakage resulted in scrams, a forced shutdown, and outage extensions. The staff noted that CARD 13-23127 also states that IER 13-17 indicates that the condenser inleakage events caused the introduction of sodium, chloride, sulfate, and other contaminants into the RCS and contributed to out-of-specification reactor water chemistry, requiring operations personnel to enter abnormal operating procedures more frequently.

In addition, the staff noted that CARD 11-21607 states that during the startup on February 10, 2011, the applicant's plant was shut down due to main condenser tube inleakage and associated water chemistry excursions. The staff also noted that CARD 11-21607 indicates that inspections of all condenser water boxes identified the ejection of tube plugs from receptive condenser tubes.

The staff noted that another of the applicant's CARD (CARD 08-26361) indicates that condenser cooling water inleakage occurred at the applicant's plant at an estimated inleakage rate of 40 to 50 gal per day. CARD 08-26361 also states that pressure testing and inspections identified the leaking condenser tube, and the tube was plugged along with several other tubes.

In its review, the staff identified the concern that the ingress of chloride, sulfate, and other contaminants into the RCS due to main condenser inleakage can promote IGSCC in BWR piping and piping welds. The staff noted that LRA Section B.1.8 and the onsite program evaluation report for the applicant's BWR Stress Corrosion Cracking Program do not clearly address the potential impact of condenser cooling water inleakage on the effectiveness of the applicant's program. Therefore, additional information is necessary to confirm that the applicant's assessment of the operating experience regarding condenser inleakage ensures the effectiveness of its program.

By letter dated December 4, 2014, the staff issued RAI B.1.8-3 requesting that the applicant clarify whether the main condenser inleakage and associated water chemistry excursions contributed to IGSCC in the piping and piping welds that are within the program scope. The staff also requested that the applicant explain whether previous occurrences of IGSCC, if any, were attributed to water chemistry control issues. In addition, the staff requested that the applicant discuss the assessment of industry and plant-specific operating experience regarding condenser cooling water inleakage and provide adequate justification for why there is no need to enhance the applicant's program.

In its response dated January 5, 2015, the applicant stated that chemistry excursions have not contributed to initiation of IGSCC because no cracking has been detected to date in any piping within the scope of the applicant's program. The applicant also stated that site water chemistry monitoring procedures and processes manage water chemistry in accordance with Electrical Power Research Institute (EPRI) guidance that is based on industry-wide operating experience, which has shown that the guidance is effective. The applicant further stated that, if a water chemistry parameter is out of specification, it addresses and corrects the issue by promptly taking action when condenser tube leakage is identified. The applicant indicated that hydrogen water chemistry and noble metal chemical addition are applied as part of the site plan to mitigate the environmental conditions and that volumetric inspections are performed in accordance with the staff-approved guidance to detect and manage IGSCC in a timely manner if it were to occur. The applicant stated that no changes to inspection population or inspection frequency are necessary based on the assessment of industry and plant-specific operating experience regarding condenser cooling water inleakage.

The staff finds the applicant's response acceptable because (1) the applicant clarified that no IGSCC has been observed to date in any piping within the scope of the Fermi 2 BWR Stress Corrosion Cracking Program, (2) operating experience supports the determination that water chemistry excursions have not contributed to IGSCC in the BWR piping at the applicant's facility, and (3) the applicant clarified that it addresses and corrects any excursions out of water chemistry specifications in a timely manner in accordance with the industry guidelines for BWR water chemistry control. The concern described in RAI B.1.8-3 is resolved.

Based on its audit, review of the application, and the applicant's response to RAI B.1.8-3, the staff finds that the applicant has appropriately evaluated the 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.M7 was evaluated.

UFSAR Supplement. LRA Section A.1.8 provides the UFSAR supplement for the BWR Stress Corrosion Cracking Program. As previously discussed, in its response to RAI B.1.8-2, the applicant adequately amended the UFSAR supplement to clarify that the Category D welds in the feedwater and condensate water systems are included in the scope of the program. Therefore, the UFSAR supplement for the BWR Stress Corrosion Cracking Program is consistent with the corresponding program description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement, as amended by letter dated January 5, 2015, is an adequate summary the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Stress Corrosion Cracking Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 BWR Vessel ID Attachment Welds

Summary of Technical Information in the Application. LRA Section B.1.9 describes the existing BWR Vessel ID Attachment Welds Program as consistent with GALL Report AMP XI.M4, "BWR Vessel ID Attachment Welds." The LRA states that the program manages cracking in structural welds for BWR reactor vessel internal integral attachments using inspections, scheduling, acceptance criteria, and flaw evaluation in conformance with the requirements of ASME Code

Section XI and guidelines of BWRVIP-48-A, “BWR Vessel and Internals Project Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines,” dated June 2004. The LRA further states that the program includes welds between the vessel wall and vessel inside diameter (ID) brackets that attach components to the vessel. The LRA also states that the internal attachment weld can be a simple weld or a weld buildup pad on the vessel.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant’s program to the corresponding program elements of GALL Report AMP XI.M4. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M4.

Operating Experience. LRA Section B.1.9 summarizes operating experience related to the BWR Vessel ID Attachment Welds Program. The LRA states that inspections were performed on the in-scope welds during RFO 8 in 2001 in accordance with the guidelines of BWRVIP-48-A. No indications of cracking were detected. The LRA also states that examinations were performed on shroud support welds in 2005, and other inspections were conducted on reactor vessel internal welds. The LRA section further states that portions of shroud support welds were last inspected during RFO 15 in 2012. No indications of cracking were detected.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects, and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

The staff noted that the LRA section states that shroud support weld examinations were performed in 2005. However, the staff’s review found no record of these examinations performed in 2005. By letter dated December 17, 2014, the staff issued RAI B.1.9-1 regarding this discrepancy. The RAI requested that the applicant provide clarification as to whether the subject inspections have been performed and, if so, provide the results and state whether any flaws were detected.

In its response dated January 20, 2015, the applicant stated that discussion on the “2005” inspections in the LRA section actually should have been “2006.” The applicant stated that it performed the shroud support visual and ultrasonic examinations during RFO 11 in 2006. The applicant further stated that no relevant indications have been noted during any of the examinations for the shroud support welds. In addition, the applicant revised LRA Section B.1.9 to change “2005” to “2006.”

The staff noted that the applicant’s response corrected the error in the year in which the inspection was performed. The staff also noted that no indications of cracking were detected during the inspection. The staff finds the applicant’s response acceptable because the applicant corrected the error and revised the LRA section accordingly. The staff’s concern described in RAI B.1.9-1 is resolved.

Based on its audit and review of the application and review of the applicant's response to RAI B.1.9-1, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M4 was evaluated.

UFSAR Supplement. LRA Section A.1.9 provides the UFSAR supplement for the BWR Vessel ID Attachment Welds Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Vessel ID Attachment Welds Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Containment Leak Rate Program

Summary of Technical Information in the Application. LRA Section B.1.13 describes the existing Containment Leak Rate Program as consistent with GALL Report AMP XI.S4, "10 CFR Part 50, Appendix J." The applicant stated that the program consists of tests performed in accordance with the requirements of Option B, "Performance-Based Requirements," of Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." The applicant also stated that, under Option B, it follows the guidance of Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," dated September 1995; the referenced NEI 94-01, "Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J"; and the American National Standards Institute (ANSI)/American Nuclear Society 56.8, "Containment System Leakage Testing Requirements."

The applicant stated that, under Option B of Appendix J to 10 CFR Part 50, the program performs Type A or integrated leakage rate testing (ILRTs) and Type B and Type C local leakage rate testing (LLRTs) at the peak calculated loss-of-coolant accident (LOCA) containment pressure and applicable frequencies to periodically demonstrate the performance of containment pressure-retaining boundary components and isolation barriers. The applicant also stated that the parameters monitored are leakage rates of the steel containment vessel and associated welds, penetrations, fittings, access openings, and age-related degradation in material properties of seals, gaskets, O-rings, and packing materials. The applicant further stated that the program, through satisfactory leakage rate tests and with the additional implementation of an acceptable containment ISI program as described in ASME Code Section XI, Subsection IWE, ensures the leak tightness and structural integrity of the containment.

The applicant stated that the leakage rate acceptance criteria are in accordance with Option B of Appendix J to 10 CFR Part 50 and are defined in the plant's Technical Specifications (TS). The applicant also stated that the program documents and trends test results and demonstrates that these results meet the requirements in the acceptance criteria.

The applicant stated that evaluations are performed for test or inspection results that do not satisfy established criteria and that corrective actions are initiated to document the issues in accordance with plant administrative procedures. The applicant also stated that the corrective action program under Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 ensures that conditions adverse to quality are corrected in accordance with applicable plant procedures that meet the requirements of Option B of Appendix J to 10 CFR Part 50. The applicant further stated that the cause of deficiencies significantly adverse to quality is determined and that an action plan is developed to prevent the recurrence of these deficiencies.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S4. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S4.

Operating Experience. LRA Section B.1.13 summarizes operating experience related to the Containment Leak Rate Program. The included operating experience in the LRA indicates that, through proper implementation of ILRTs, LLRTs, and IWE ISIs, collectively, there is a reasonable assurance the leak tightness and structural integrity of the primary containment are maintained and will continue to be maintained during the period of extended operation. For example, the applicant stated that, from 2003 to 2013, all of the "as-found" Type B tests performed at penetrations yielded acceptable leakage rate results. An exception occurred in 2009 when the "as-left" leakage rate of an equipment hatch was above the acceptance criteria due to faulty seals. However, it was considered acceptable as is because the sum of individual LLRT results was below the acceptance limit. The applicant promptly replaced the failing seals during the following RFO in 2010. The ILRT performed in 2007 yielded acceptable "as-found" leakage rate results before factoring in the leakage rates of the feedwater check valves. The applicant found that the cause of the excessive leakage of four check valves was related to the erosion of their soft valve seats. The applicant then replaced the seats and subsequently retested the valves; these actions satisfied the LLRT acceptance criteria before the unit's restart. To prevent recurrence, the replacement frequency of all feedwater check valve soft seats was increased to every RFO. Upon further review of the situation, it was determined that the intended function of the primary containment associated with the containment isolation valves was not impacted.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S4 was evaluated.

UFSAR Supplement. LRA Section A.1.13 provides the UFSAR supplement for the Containment Leak Rate Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Containment Leak Rate Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Environmental Qualification (EQ) of Electric Components

Summary of Technical Information in the Application. LRA Section B.1.15 describes the existing Environmental Qualification (EQ) of Electric Components Program as consistent with GALL Report AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The LRA states that the AMP addresses Criterion 4, "Environmental and Dynamic Effects Design Bases," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, and 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," which specifically requires the establishment of an EQ program to demonstrate that certain electrical components located in a harsh environment (i.e., those areas of the plant that could be subject to the harsh environmental effects of a LOCA, high-energy line breaks (HELBs), or high radiation) are qualified to perform their safety function in those harsh environments. The LRA also states that 10 CFR 50.49 requires the applicant to address the effects of significant aging mechanisms as part of EQ. Further, the applicant stated that, 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. LRA Section B.1.15 notes that the reanalysis of an aging evaluation addresses attributes of the analytical methods, data reduction and collection methods, underlying assumptions, acceptance criteria, and corrective actions. The LRA also states that some aging evaluations for EQ components are time-limited aging analyses (TLAAs) for license renewal. Finally, the applicant indicated that continued implementation of the Environmental Qualification (EQ) of Electric Components Program provides reasonable assurance that equipment qualification will be maintained and that the effects of aging will be managed so that components crediting this program can perform their intended function consistent with the CLB during the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP X.E1.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP X.E1.

Operating Experience. LRA Section B.1.15 summarizes operating experience related to the Environmental Qualification (EQ) of Electric Components Program. For Fermi 2, the applicant referenced an EQ-program-focused self-assessment that identified one strength and 12 corrective action documents containing deficiencies and recommendations. As described in the LRA, none of the deficiencies involved failure to maintain equipment EQ. The applicant also referenced an example of completed corrective actions, including updating the plant equipment database, as a result of missing EQ bases documentation discovered during the EQ reconstitution project of 2012.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

Operating experience reviewed included confirmation of EQ program updates resulting from revised environments associated with an extended power uprate and a measurement uncertainty recapture (MUR) power uprate. The staff also reviewed quarterly EQ program health reports issued for 2011, 2012, 2013, and 2014. The self-assessment results for 2011 resulted in an overall score of “white.” The same was noted for self-assessments performed in 2012 and for 2013 but with three of four categories rated as “green” for 2013. The first quarter health report for 2014 improved to an overall rating of “green” attributed, in part, to the qualification of additional personnel and resolution of self-assessment deficiencies.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP X.E1 was evaluated.

UFSAR Supplement. LRA Section A.1.15 provides the UFSAR supplement for the Environmental Qualification (EQ) of Electric Components Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Environmental Qualification (EQ) of Electric Components Program for managing the effects of aging for applicable components during the period of extended operation.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant’s Environmental Qualification (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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Inservice Inspection

Summary of Technical Information in the Application. LRA Section B.1.21 describes the applicant's existing Inservice Inspection (ISI) Program as consistent with GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The LRA states that the program manages loss of material, cracking, and reduction in fracture toughness for ASME Code Class 1, 2, 3 pressure-retaining components, which include welds; pump casings; valve bodies; integral attachments; and pressure-retaining bolting using volumetric, surface, and/or visual examinations and leakage testing, as specified in ASME Code Section XI with NRC-approved alternatives.

In addition, the LRA states that the ISI Program includes limitations, modifications, and augmented inspection described in 10 CFR 50.55a. The LRA further states that the program is updated every 10 years to the latest ASME Code Section XI edition and addenda approved by the NRC in 10 CFR 50.55a. The LRA also states that the ISI program is consistent with the program described in GALL Report Section XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M1. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M1.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M1.

Operating Experience. LRA Section B.1.21 summarizes operating experience related to the applicant's ISI Program. The applicant stated that, in 2008, an in-depth self-assessment for its second 10-year interval of the ISI nondestructive examination (NDE) program plan was performed. The applicant also stated that, as a result of these assessments, issues and recommendations were identified that were entered into the corrective actions program and that actions related to these corrective actions and recommendations were completed. The applicant further stated that the self-assessment concluded that the second interval NDE plan was comprehensive and met the objectives of ASME Code Section XI.

LRA Section B.1.21 also provides specific examples of the applicant's operating experience. The LRA states that, during the performance of thickness examinations by UT of the diesel generator service water piping during the RFO of 2010, it identified sections of piping with significant wall thickness reductions. The applicant also stated that this identification resulted in the degraded condition being entered into the corrective actions program, which required engineering evaluations to determine acceptability for further service or replacement. The applicant further stated that, in 2012, 44 components were examined and no significant issues were identified. The applicant further stated that based on the history of identification of degradation and initiation of corrective actions before loss of intended function, its Inservice Inspection Program provides assurance that future inspections will continue to remain effective such that components will perform their intended functions through the period of extended operation.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

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

UFSAR Supplement. LRA Section A.1.21 provides the UFSAR supplement for the Inservice Inspection Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

Conclusion. On the basis of its audit and review of the applicant's ISI Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 Internal Surfaces in Miscellaneous Piping and Ducting Components

Summary of Technical Information in the Application. LRA Section B.1.24 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 nonmetallic piping and components in environments other than open-cycle cooling water, closed treated water, and fire 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. 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.

Although the frequency and size of the representative inspection sample for this program is consistent with the “detection of aging effects” program element in GALL Report AMP XI.M38, this program is being used to manage the air side of several room coolers that are within the scope of GL 89-13, “Service Water System Problems Affecting Safety-Related Equipment,” dated July 18, 1989. LRA Section B.1.24 states that a 20-percent sample will be inspected during each 10-year period, at a minimum. However, GL 89-13 specifies a minimum test frequency of 5 years for each safety-related heat exchanger cooled by open-cycle service water and includes air-side inspections for heat exchangers that are not tested. It was unclear to the staff whether the air-side inspection frequency of the room coolers would be consistent with the guidance provided in GL 89-13. By letter dated December 19, 2014, the staff issued RAI B.1.24-1 requesting that the applicant provide information on the aging management activities for the room coolers.

In its response dated January 28, 2015, the applicant stated that Enclosure B of the Fermi 2’s Engineering Support Conduct Manual MES52, “GL 89-13 Safety-Related Service Water Monitoring Program,” controls the frequency of the preventive maintenance (PM) activities associated with the air-side inspections for each ESFs fan coil unit. In addition, the applicant verified that the inspection frequency is at least once every 5 years and meets the requirements of GL 89-13. The staff finds the applicant’s response acceptable because the frequency of the air-side inspections to detect fouling in the room coolers is at least once every 5 years and continues to be specified through the site procedure associated with GL 89-13. The staff’s concerns described in RAI B.1.24-1 are resolved.

In reviewing the program for consistency with the GALL Report, the staff notes that the applicant’s program includes fouling as an aging effect requiring management and that management of fouling is not consistent with GALL Report AMP XI.M38. The program proposes to manage reduction of heat transfer due to air-side fouling of heat exchanger fins and tubes by using periodic visual inspections. The staff notes that GL 89-13 identifies periodic air-side visual inspections to ensure cleanliness of air-to-water heat exchangers as an acceptable approach for verifying heat transfer capability. The staff finds that cleanliness of heat exchanger tubes and fins can be readily identifiable through periodic visual inspections during system inspections and walkdowns. Based on the discussion above and SER Section 3.3.2.3.6, the staff finds that the visual inspections in this program are capable of detecting fouling of air-side heat exchanger surfaces before loss of the intended function.

Based on its audit and review of the applicant’s response to RAI B.1.24-1, 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.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.1.24 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. LRA Section B.0.4, “Operating Experience,” also states that future plant-specific and industry operating experience will be reviewed on an ongoing basis to evaluate the program’s effectiveness, and the first evaluation will be performed within 5 years of implementing the new program.

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.

UFSAR Supplement. LRA Section A.1.24 provides the UFSAR supplement for the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. The staff also noted that the applicant committed to implement the new Internal Surfaces in Miscellaneous Piping and Ducting Components Program before the period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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

3.0.3.1.12 Metal Enclosed Bus Inspection

Summary of Technical Information in the Application. LRA Section B.1.26 describes the new Metal Enclosed Bus Inspection Program as consistent with GALL Report AMP XI.E4 "Metal Enclosed Bus." The applicant stated that the Metal Enclosed Bus Inspection Program is a new condition monitoring program that will provide for the inspection of the internal and external portions of the 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. The program will inspect the MEB between combustion turbine generator (CTG) transformer CTG 11-1 and peaker bus 1-2B located in the 120-kV switchyard. The MEB associated with the CTG 11-1 is used as the alternate alternating current (AC) source for a station blackout event, and it supports response by the dedicated shutdown panel to an Appendix R ("Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50) fire.

The applicant stated that the Metal Enclosed Bus Inspection Program is a new program. Industry and plant operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is implemented and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 QA program under Appendix B to 10 CFR Part 50.

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.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E4.

Operating Experience. LRA Section B.1.26 summarizes operating experience related to the Metal Enclosed Bus Inspection Program. The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

During its review, the staff 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.

UFSAR Supplement. LRA Section A.1.26 provides the UFSAR supplement for the Metal Enclosed Bus Inspection Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implementing the new Metal Enclosed Bus Inspection Program before September 20, 2024, or the end of the last RFO before March 20, 2025, whichever is later, for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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

3.0.3.1.13 Non-EQ Cable Connections

Summary of Technical Information in the Application. LRA Section B.1.28 describes the new Non-EQ 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 AMP is a one-time inspection on a sample of connections that must be completed before the period of extended operation. Cable connections in this AMP are those connections susceptible to age-related degradation resulting in increased resistance due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the EQ requirements of 10 CFR 50.49. The factors considered for sample selection are application (i.e., medium and low voltage defined as less than 35 kV), circuit loading (i.e., high loading), connection type, and location (e.g., high temperature, high humidity, and vibration). The representative sample size will be based on 20 percent of the connection population with a maximum sample of 25. Inspection methods may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation (e.g., heat shrink tape, sleeving, and insulation 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.

For the "parameters monitored or inspected" program element, the staff determined the need for additional information, which resulted in the issuance of RAI B.1.28-2, as discussed below.

The "parameters monitored or inspected" program element in GALL Report AMP XI.E6 recommends testing a representative sample of electrical cable connections. The following factors are considered for sampling: voltage level (i.e., medium and low voltage), circuit loading (i.e., high load), connection type, and location (e.g., high temperature, high humidity, and vibration). The technical basis for the sample selection is documented.

The applicant's "detection of aging effects" program element of the LRA AMP basis document states that "the technical basis for the sample selected will be documented." However, the sample selection methodology and the technical basis were not developed by the applicant and were not available for the staff to review at the time of the audit.

During the AMP audit, the staff requested the operating experience associated with the tap box connections, including records of maintenance activities performed. The applicant did not find any maintenance activities or reported operating experience for tap box connections. In addition, the applicant's PM program did not include the tap box connections. Further, it was not clear to the staff that these in-scope connections would be included in the sample population or considered as a sampling program connection type. By letter dated January 14, 2015, the staff issued RAI B.1.28-2 requesting that the applicant justify that a one-time test, on a sampling basis, in accordance with LRA AMP B.1.28, is adequate to ensure that in-scope tap box connection intended functions will be maintained consistent with the CLB for the period of extended operation. The staff also requested that the applicant explain whether a representative number of tap box connections will be included in the overall population and will be represented as a sampling program connection type as part of applicant's sampling methodology.

In its response dated February 12, 2015, the applicant stated that the tap boxes are uniquely designed and will be grouped as a specific connection type for the purpose of sample selection. The applicant will revise LRA Sections A.1.28 and B.1.28 to identify the tap box connections as a specific group in the sample selection criteria. The applicant also stated that for electrical connections that are not part of electrical components requiring routine or periodic maintenance (i.e., tap box connections), a one-time test and connection disassembly and reassembly will confirm that the existing design and installation and maintenance practices have been effective. Further, in response to an industry event report, the applicant developed cable bus PM that includes inspection of the tap box connections. The cable bus PM are coordinated with the 12-year transformer and switchgear PM.

The staff finds the applicant's response acceptable because the tap box electrical connections will be included in the connection population and treated as a specific group in the LRA AMP B.1.28, "Non-EQ Cable Connections," sample selection criteria consistent with GALL Report AMP XI.E6 sampling program guidance. In addition, tap box connection PM has been developed and coordinated with transformer and switchgear PM. The staff's concern described in RAI B.1.28-2 is resolved.

Based on its audit and review of the applicant's response to RAI B.1.28-2, 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.E6.

<u>Operating Experience</u>. LRA Section B.1.28 summarizes operating experience related to the Non-EQ Cable Connections Program. The Non-EQ Cable Connections Program is a new program with industry and plant operating experience considered in the implementation of the program. The LRA states that plant operating experience will be gained as the program is implemented and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 QA program under Appendix B to 10 CFR Part 50. Further, the LRA states that the Non-EQ Cable Connections Program applies to potential aging effects for which there is no operating experience at Fermi 2, indicating the need for a Non-EQ cable connections AMP.

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 plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

During its onsite audit, the staff reviewed plant maintenance procedures that included procedures for verifying the torque of bolted electrical connections. The staff found that the applicant's procedures were inconsistent with the guidelines in EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," concerning verification of the proper torque of bolted electrical connections.

Therefore, by letter dated January 14, 2015, the staff issued RAI B.1.28-1 requesting that the applicant explain why plant procedures specify the re-torqueing of bolted connections versus the recommended practice referenced in EPRI TR-104213 not to re-torque bolted electrical connections once the fastener is in service.

In its response dated February 12, 2015, the applicant stated that re-torqueing will not be used as an alternative to thermography or resistance checks for the detection of aging effects on bolted electrical connections. The applicant will revise LRA Sections A.1.26, A.1.28, B1.26, and B.1.28 to clarify that torque checking will not be used as an alternative method to thermography or resistance checks.

The staff finds the applicant's response acceptable because the concerns over re-torqueing of electrical connections have been alleviated. The applicant's revisions to LRA Sections A.1.26, A.1.28, B1.26, and B.1.28 prevent potential harm due to re-torqueing. The staff's concern described in RAI B.1.28-1 is resolved.

UFSAR Supplement. LRA Section A.1.28 provides the UFSAR supplement for the Non-EQ Cable Connections Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff also noted that the applicant committed (Commitment No. 21) to implement the new Non-EQ Cable Connections Program before September 20, 2024, or at the end of the last RFO before March 20, 2025, whichever is later for managing the effects of aging for applicable components.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Non-EQ 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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 Non-EQ Inaccessible Power Cable (400 V to 13.8 kV)

Summary of Technical Information in the Application. LRA Section B.1.29 describes the new Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program as consistent with GALL Report AMP XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The LRA states that the Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is a condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power cables (400 V to 13.8 kV) that have a license renewal intended function. The in-scope cables identified by the LRA are routed underground in conduit or duct bank or are directly buried. The applicant further stated that industry and plant-specific operating experience will be considered in the implementation of this program and factored into the program via the applicant's corrective action program.

The applicant also stated that in-scope inaccessible power cables exposed to significant moisture will be tested every 6 years to provide an indication of the conductor insulation with the first tests occurring before the period of extended operation. The tests are to be proven and commercially available for detecting deterioration of the cable insulation. The applicant's program includes periodic inspections for water accumulation in manholes at least once a year, including manhole inspections after events, such as heavy rain or flooding. The program allows the inspection frequency to be adjusted as necessary based on evaluation of inspection results. The LRA states that the Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program will be implemented 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.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E3.

Operating Experience. LRA Section B.1.29 summarizes operating experience related to the Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program. The applicant stated that plant operating experience will be gained as the program is implemented and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 QA program under Appendix B to 10 CFR Part 50. The applicant identified actions taken in response to industry and plant-specific operating experience. Actions included the installation of sump pumps, periodic pumping and monitoring of cable vaults and manholes, manhole and vault repair, emergency diesel generator (EDG) raceway and cable replacement, and cable-monitoring procedure development.

The applicant's response to GL 07-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients," dated February 7, 2007, identified three power cable failures. The failures included, (1) the normally energized station blackout combustion turbine generator transformer cooler backup 480-VAC power cable, (2) a 260-V direct current (DC), normally energized 130-V DC circulating water pump house distribution panel power cable, and (3) a 260-V DC, normally energized, 130-V DC general service water pump house power cable. Of the three power cable failures, the LRA identified the normally energized station blackout combustion turbine generator transformer cooler backup 480-VAC power cable as within the scope of license renewal. The LRA noted that this cable had been in service for approximately 39 years and that the probable cable cause of the failure was degraded conduit or degraded cable insulation.

As described in Fermi 2 Power Plant, Unit 2, Integrated Inspection Report 05000341/2011005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML120300106), the inspection selected underground bunkers/manholes subject to flooding that contained cables whose failure could disable risk-significant equipment. The inspectors determined that the cables were not submerged, splices were intact, and appropriate cable support structures were in place. In those areas where dewatering devices were used, the device was operable and level alarm circuits were set appropriately to ensure that the cables would not be submerged. In those areas without dewatering devices, the inspectors verified that drainage of the area was available or that the cables were qualified for submergence conditions. The inspectors also reviewed the licensee's corrective action documents with respect to past submerged cable to verify the adequacy of the corrective actions. The inspectors performed a walkdown of underground bunkers/manholes 16552 and 16950 with safety-related and security-related cables. No findings were identified during the inspection.

Fermi 2 Integrated Inspection Reports 05000341/2009005 (ADAMS Accession No. ML100340164) and 05000341/2012005 (ADAMS Accession No. ML13028A454) include the evaluation of selected underground bunkers/manholes subject to flooding that contained cables whose failure could disable risk-significant equipment. The inspection determined that cables were not submerged, splices were intact, and appropriate cable support structures were in place. Dewatering devices were operable and level alarm circuits were set appropriately to ensure the cables would not be submerged. In those areas without dewatering devices, the inspectors verified that drainage of the area was available or that the cables were qualified for submergence conditions. Corrective actions with respect to past submerged cable issues were evaluated to verify the adequacy of the corrective actions. Walkdowns were performed on security cable manholes and residual heat removal (RHR)/EDG manholes. Additionally, Integrated Inspection Reports 05000341/2013002 (ADAMS Accession No. ML13127A206) and 05000341/2013003 (ADAMS Accession No. ML13210A073) evaluated work orders for weekly performance of manhole water level monitoring. NRC Inspection Manual, Inspection Procedure 71111, Attachment 06, Section 02.02, "Inspection Activities," clarifies that "[i]f neither dewatering devices nor drainage have been installed, verify that the operational environment of the cables is consistent with the manufacturer's design specifications and qualification criteria." No findings were identified during the inspections.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E3 was evaluated.

UFSAR Supplement. LRA Section A.1.29 provides the UFSAR supplement for the Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 22) to implement the new Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program before September 20, 2024, or at the end of the last RFO before March 20, 2025, whichever is later for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) 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 will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.15 Non-EQ Instrumentation Circuits Test Review

Summary of Technical Information in the Application. LRA Section B.1.30 describes the new Non-EQ 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 applicant stated that this is a new performance monitoring program to manage aging of in-scope cable and connection insulation for the following monitoring systems:

- neutron monitoring
  - intermediate range channels
  - average power range monitors (includes local power range monitor detector strings)

- process radiation monitoring
  - Control Center emergency air inlet radiation monitors
  - fuel pool ventilation exhaust radiation monitors
  - main steam line radiation monitors

The applicant described the Non-EQ Instrumentation Circuits Test Review Program as an AMP that will manage reduced insulation resistance of conductor and connector insulation material used in high-voltage, low-current instrumentation signal applications. As discussed in the LRA, the Non-EQ Instrumentation Circuits Test Review Program age manages non-EQ sensitive instrumentation circuits subjected to adverse localized environments caused by heat, radiation, and moisture. The applicant stated that the program consists of the review of instrumentation circuit calibration results or that the findings of surveillance testing programs will provide sufficient indication for corrective actions based on instrument calibration and test acceptance criteria. The LRA also states that the Non-EQ Instrumentation Circuits Test Review Program review of calibration results or findings of surveillance testing programs will be performed once every 10 years with the first review occurring before the period of extended operation.

The LRA program description and AMP basis document also state that cable system testing will be performed for in-scope sensitive instrument cables that are disconnected during instrument calibration. The applicant further stated that when detectors are disconnected during calibration, the cable system test will use a proven method for detecting reduced insulation resistance of the instrumentation cable and connection insulation system. The first test will be completed before the period of extended operation and subsequent tests will occur at least every 10 years.

The applicant stated that industry operating experience will be considered in the implementation of the program and that plant operating experience will be gained as the program is executed and factored into the program via the Fermi 2 QA program under Appendix B to 10 CFR Part 50, as discussed in LRA Section B.0.4.

<u>Staff Evaluation</u>. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant’s program to the corresponding program elements of GALL Report AMP XI.E2.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E2.

<u>Operating Experience</u>. LRA Section B.1.30 summarizes operating experience related to the new Non-EQ Instrumentation Circuits Test Review Program. The LRA states that Fermi 2 has experienced failures with cables and connections of neutron monitoring, and a review of these failures showed that aging mechanisms are consistent with those addressed in 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's review of plant-specific operating experience also noted corrective actions associated with cable and connector insulation degradation. However, 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.E2 was evaluated.

UFSAR Supplement. LRA Section A.1.30 provides the UFSAR supplement for the Non-EQ Instrumentation Circuits Test Review Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff also noted that the applicant committed (Commitment No. 23) to implement the new Non-EQ Instrumentation Circuits Test Review Program before September 20, 2024, or at the end of the last RFO before March 20, 2025, whichever is later for managing the effects of aging for applicable components.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Non-EQ 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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.16 Non-EQ Insulated Cables and Connections

Summary of Technical Information in the Application. LRA Section B.1.31 describes the new Non-EQ Insulated Cables and Connections Program as consistent with GALL Report AMP XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The LRA states that the new Non-EQ Insulated Cables and Connections Program is a 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 LRA further states that 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. The applicant concluded that inspection of accessible cables will represent, with reasonable assurance, all cables and connections in an adverse environment. The applicant noted that an adverse localized equipment environment is a plant-specific condition that will be determined on a plant spaces approach. The applicant determines the plant space adverse localized environment based on the most limiting temperature, radiation, or moisture condition for the cable and connection insulation within that plant space. As a new program, the applicant stated that industry operating experience will be considered in the implementation of this program and that plant-specific operating experience will be gained as the program is executed and factored into the program through the Fermi 2 QA program under Appendix B to 10 CFR Part 50. Finally, the Non-EQ Insulated Cables and Connections Program as described in the LRA will visually inspect accessible cables in an adverse localized environment at least every 10 years with the first inspection before the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.E1. 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 identifies an adverse localized environment as a plant-specific condition; therefore, the applicant should clearly define how this condition is determined. The applicant should determine and inspect the adverse localized conditions for each of the most limiting temperature, radiation, or moisture conditions for the accessible cables and connections that are within the scope of license renewal.

GALL Report AMP XI.E1 states that adverse localized environments can be identified through the use of an integrated approach. This approach may include, but is not limited to, (a) the review of EQ zone maps that show radiation levels and temperatures of various plant areas, (b) consultations with plant staff who are cognizant of plant conditions, (c) utilization of infrared thermography to identify hot spots on a real-time basis, and (d) the review of relevant plant-specific and industry operating experience. Additionally, SRP-LR Section 2.5.1 states that an applicant may use the so-called "plant spaces" approach instead of identifying specific electrical and instrument and control components.

During its audit, the staff observed that the applicant's Non-EQ Insulated Cables and Connections Program "plant spaces" approach is not part of the integrated approach referenced by GALL Report AMP XI.E1 or the SRP-LR. Additionally, the use of a "plant spaces" approach on its own may not consider relevant plant-specific or industry operating experience or other aspects for the identification of an adverse localized environment, as described in GALL Report AMP XI.E1.

By letter dated December 22, 2014, the staff issued RAI B.1.31-1 requesting that the applicant explain how the use of the "plant spaces" scoping and screening approach, as described in SRP-LR Section 2.5.1, "Areas of Review," was adopted to identify adverse localized environments consistent with the integrated approach described in GALL Report AMP XI.E1, including the use of EQ zone map reviews, consultations with plant staff, plant-specific and industry operating experience, inspection, and testing (e.g., thermography).

In its response dated January 30, 2015, the applicant stated that it revised the description in LRA Section B.1.31, "Non-EQ Insulated Cables and Connections," to clarify how adverse localized environments can be identified using an integrated approach. The method described in the LRA for identifying adverse localized environments, as revised, is consistent with the GALL Report.

The staff finds the applicant's response acceptable because the applicant provided a revision to LRA Section B.1.31 that combines the "plant spaces" approach with the integrated approach recommended in GALL Report AMP XI.E1. With the revision to LRA Section B.1.31, the staff concludes that the applicant's Non-EQ Insulated Cables and Connections Program is consistent with GALL Report AMP XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The staff's concern described in RAI B.1.31-1 is resolved.

During the audit, the staff noted that a Calvert cable bus was installed in the station blackout/offsite power recovery path from the SS 65 transformer to 4160 bus 65 but was not identified in the applicant's LRA or basis documents as being age managed during the period of extended operation. The staff also observed a large number of birds on and around the Calvert cable bus, SS 64 transformer, and 4160 bus 65 that, if left unmanaged, could potentially result in accelerated age degradation of these components due to bird-debris contamination.

The staff requested that that the Region III consider the above concerns when developing the 71002 inspection. Subsequently, as part of the inspection, the staff requested that the applicant address the potential for bird debris to degrade the Calvert cable bus, metallic tray structure, spacers, and insulators and identify the LRA AMP(s) intended to manage the potential aging mechanisms and effects. As documented in Inspection Report 05000341/2015109 (ADAMS Accession No. ML15162B041), the applicant committed to update adverse localized environments to include chemical contamination from bird droppings. The applicant issued CARD 15-23107, "Revisions to LRA Resulting from April 2015 NRC Inspection 71002," to resolve the issue. By letter dated May 19, 2015, the applicant submitted NRC-15-0056, "Response to NRC RAI for the Review of the Fermi 2 LRA – Set 32." Under Enclosure 5, "Additional License Renewal Application Revisions from April 2015 NRC Inspection," the applicant revised the LRA to include contamination (e.g., bird debris in contact with cable in the bus enclosure) as a condition resulting in an adverse localized environment. Specifically, the applicant incorporated the following changes to the Non-EQ Insulated Cables and Connections Program:

- a revision to Supplement A.1.31, "Non-EQ Insulated Cables and Connections Program," to the final safety analysis report (FSAR) that includes "chemical contamination (i.e., bird droppings)" as an adverse localized environment
- a modification to the LRA Section B.1.31, "Non-EQ Insulated Cables and Connections Program," description that includes "chemical contamination (i.e., bird droppings)" as an adverse localized environment
- a revision to LRA Section A.4, Commitment No. 24, "Non-EQ Insulated Cables and Connections," that includes "chemical contamination (i.e., bird droppings)" as an adverse localized environment

Inspection Report 05000341/2015109 (ADAMS Accession No. ML15162B041) concludes that implementation of the Non-EQ Insulated Cables and Connections Program as described in the LRA, should provide reasonable assurance that aging effects will be managed, consistent with the license basis, for the period of extended operation. The staff finds the applicant's response acceptable because the applicant modified LRA Section B.1.31, "Non-EQ Insulated Cables and

Connections Program"; revised FSAR Supplement A.1.31, "Non-EQ Insulated Cables and Connections Program"; and revised LRA Section A.4, Commitment No. 24, "Non-EQ Insulated Cables and Connections," to include chemical contamination (bird droppings) as an adverse localized environment. With the addition of chemical contamination, the potential aging mechanism of bird debris will be adequately age managed during the period of extended operation. The staff's concern described in Inspection Report 05000341/2015109 (ADAMS Accession No. ML15162B041) is resolved.

Based on its audit and review of the applicant's response to RAI B.1.31-1, and response letter dated May 19, 2015, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E1.

Operating Experience. LRA Section B.1.31 summarizes operating experience related to the Non-EQ Insulated Cables and Connections Program. The LRA identified plant operating experience examples. A summary of the operating experience is given below.

In 2009 cable heat damage was identified in the limit switch compartment of a feedwater heater inlet isolation valve. Degraded and damaged cables were replaced, and surrounding cables were inspected and evaluated in the subsequent corrective action work order in 2010.

Age-related cable brittleness was identified in 2006. Work requests were initiated to replace degraded cables on the turbine valve unitized actuators. Cable replacements were completed in 2009 and 2012.

The staff's review of plant operating experience identified corrective actions, including performing cable condition walkdowns to identify cables in close proximity to high-temperature equipment, the identification of cables that may be operating above ampacity limits, the replacement of motor operator heat-damaged control cable, and the establishment of a cable-monitoring program.

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, and response letter dated May 19, 2015, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E1 was evaluated.

UFSAR Supplement. LRA Section A.1.31 provides the UFSAR supplement for the Non-EQ Insulated Cables and Connections Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff also noted that the applicant committed (Commitment No. 24) to implement the new Non-EQ Insulated Cables and Connections Program before September 20, 2024, or at the end of the last RFO before March 20, 2025, for managing the effects of aging for applicable components.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Non-EQ Insulated Cables and 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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 One-Time Inspection

Summary of Technical Information in the Application. LRA Section B.1.33, as amended by letters dated April 27, 2015, and June 9, 2015, describes the new One-Time Inspection Program as consistent with GALL Report AMP XI.M32, "One-Time Inspection." The LRA states that the AMP consists of one-time NDEs of selected components for each material-environment-aging effect population to verify that unacceptable degradation is not occurring. The specific aging effects addressed by the program are loss of material, reduction of heat transfer, and cracking. The LRA also states that the AMP will verify the effectiveness of Diesel Fuel Monitoring, Oil Analysis, and Water Chemistry Control BWR programs. In addition, the AMP will include inspections of the stainless steel reactor vessel flange leak-off piping, valve body, the mechanical draft cooling tower (MDCT) galvanized spray headerspray piping, and a representative sample of internal and external surfaces of core spray, RHR, high-pressure coolant injection (HPCI) turbine exhaust, nuclear pressure relief, and reactor core isolation cooling piping that passes through the waterline region of the suppression pool. Additionally, the LRA states that a representative sample of internal surfaces of the normally dry suppression chamber spray piping that is periodically wetted by the RHR system testing will be inspected by the One-Time Inspection Program. The one-time inspections will be conducted in the 10 years before entering 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.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M32.

Operating Experience. LRA Section B.1.33 states that the One-Time Inspection Program is a new program and that industry operating experience will be considered during implementation.

The staff reviewed operating experience during the audit to determine whether the applicable aging effects and industry operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program. The staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M32 was evaluated.

UFSAR Supplement. LRA Section A.1.33, as amended by letters dated April 27, 2015, and June 9, 2015, provides the UFSAR supplement for the One-Time Inspection Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to conduct the inspections covered by the One-Time Inspection Program within the 10 years before March 20, 2025. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's One-Time Inspection Program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.18 One-Time Inspection – Small-Bore Piping

Summary of Technical Information in the Application. LRA Section B.1.34 describes the new One-Time Inspection – Small-Bore Piping Program as consistent with GALL Report AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." The applicant stated that this program will augment ASME Code Section XI requirements and will be 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. 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 the program will provide for a one-time volumetric or opportunistic destructive (for socket welds only) inspection of weld locations that are susceptible to cracking. The applicant stated that because it does not have more than 30 years of operation at the time of submitting its LRA, its inspections would include 10 percent of the weld population or a maximum of 25 welds from each type of weld (e.g., full penetration or socket weld).

In addition, the applicant stated that volumetric examinations will be performed using a demonstrated technique capable of detecting cracking. The applicant further stated that the program will include pipes, fittings, branch connections, and full and partial penetration welds. The applicant also stated that the program's sampling approach will be based on susceptibility to stress corrosion; cyclic loading, including thermal, mechanical, and vibration fatigue; thermal stratification; thermal turbulence; and failure history.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared elements 1 through 6 of the applicant's program to the corresponding 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 was not clear to the staff how the inspection sample will be selected and thus whether a sufficient number of locations will be inspected to ensure that cracking will be adequately managed.

By letter dated December 19, 2014, the staff issued RAI B.1.34-1 requesting that the applicant provide the population of in-scope small-bore piping welds for each weld type (e.g., butt welds and socket welds). The applicant was asked to justify the adequacy of the selected sample size for each type of weld based on the population of in-scope welds.

In its response dated January 28, 2015, the applicant stated that, in total, there are approximately 4,200 in-scope small-bore piping welds. The applicant also stated that 4,000 of those are socket welds, whereas 200 are butt welds. The applicant further stated that EPRI TR-107514, "Age Related Degradation Inspection Method and Demonstration," describes a sampling program. The applicant stated that, by using the mathematical analysis in EPRI TR-107514, it was determined that, in order to provide a 90-percent confidence that 90 percent of a given population has no degradation, an inspection plan for a large population should have a sample size of 25. The applicant stated that based on this analysis, 25 is the maximum number of inspections recommended for each weld type.

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 to adequately select the proper inspection sample size for the population of its small-bore piping welds. The staff finds the applicant's response acceptable (1) because, based on the applicant's plant-specific operating experience (i.e., less than 30 years of operation at the time of application for license renewal and no incidence of failures observed for its ASME Code 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 10 percent of the weld population or a maximum of 25 welds for each weld type, and (2) because the applicant justified its inspection sample size for its weld population through analyses. The staff's concern described in RAI B.1.34-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.1.34-1, the staff finds that elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M35.

Operating Experience. LRA Section B.1.34 summarizes operating experience related to the One-Time Inspection-Small-Bore Piping Program. The applicant stated that it does not have any operating experience related to cracking of ASME Code 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 executed and will be factored into the program through its corrective action and QA programs.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff found no 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.M35 was evaluated.

UFSAR Supplement. LRA Section A.1.34 provides the UFSAR supplement for the One-Time Inspection – Small-Bore Piping Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the corresponding program description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implementing the new One-Time Inspection – Small-Bore Piping Program within 6 years before entering the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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

3.0.3.1.19 Selective Leaching

Summary of Technical Information in the Application. LRA Section B 1.40 describes the new Selective Leaching Program as consistent with GALL Report AMP XI.M33, "Selective Leaching," as modified by LR-ISG-2011-03. The LRA states that the program addresses gray cast iron and copper alloy (with greater than 15-percent zinc or greater than 8-percent aluminum) components susceptible to selective leaching exposed to raw water, treated water, waste water, or soil to manage the effects of loss of material. The LRA also states that it will manage this aging effect through a one-time visual inspection of a selected sample population of each material and environment combination, coupled with a hardness measurement or other mechanical examination techniques. The LRA states that the inspection population will consist of 20 percent of each population with the same material and environment with a maximum size of 25 components. The LRA also states that, where practical, the components would be selected from those bounding or leading components most susceptible to aging due to time in service, severity of operating condition, and lowest design margin.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M33. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M33.

Operating Experience. LRA Section B.1.40 summarizes operating experience related to selective leaching and states that no occurrences of selective leaching have been identified at Fermi 2. The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

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 the program, when implemented, will adequately manage the effects of aging due to selective leaching. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M33 was evaluated.

UFSAR Supplement. LRA Section A.1.40 provides the UFSAR supplement for the Selective Leaching Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the new Selective Leaching Program within the 5 years before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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

3.0.3.1.20 Water Chemistry Control – BWR

Summary of Technical Information in the Application. LRA Section B.1.43, as amended by letter dated June 26, 2015, describes the existing Water Chemistry Control – BWR Program as consistent, with an exception, with GALL Report AMP XI.M2, "Water Chemistry." The LRA states that the AMP manages loss of material, cracking, and fouling in components exposed to a treated water environment. The AMP proposes to manage these aging effects through monitoring and control of water chemistry parameters consistent with guidance in EPRI Report 3002002623, "BWRVIP-190: BWR Vessel and Internals Project, BWR Water Chemistry Guidelines – 2015 Revision." The LRA also states that one-time inspections of a representative sample will be performed, including components in low and stagnant flow areas, to verify the effectiveness of the Water Chemistry Control – BWR 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.M2.

Exception. LRA Section B.1.43 includes an exception to the "Program Description" of the Water Chemistry Control – BWR Program. In this exception, the applicant stated that "EPRI reports such as ‘BWR Water Chemistry Guidelines’ are industry reports, which are reviewed and revised by industry experts to incorporate recent industry operating experience and best practices.” Additionally, the applicant stated that Fermi 2 will be using EPRI Report 3002002623, BWRVIP-190, “BWR Water Chemistry Guidelines,” Revision 1, rather than the GALL Report recommendation BWRVIP-190, EPRI 1016579. The staff reviewed this exception against the corresponding program elements in GALL Report AMP XI.M2 and finds it acceptable because Revision 1 to the BWRVIP-190, “BWR Water Chemistry Guidelines,” incorporates the latest industry operating experience and best practices. Additionally, the BWRVIP-190, “BWR Water Chemistry Guidelines,” Revision 1, does not take away or relax any of the relevant guidelines from the previous revision.

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. The staff also reviewed the exception associated with the “Program Description” of the Water Chemistry Control – BWR Program and the justification and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.43 summarizes operating experience related to the Water Chemistry Control – BWR Program. A few of the recent examples are summarized below.

In 2011, during startup from a planned outage, chemistry samples indicated an increase in condensate chlorides and conductivity. These levels continued to increase, indicating circulating water inleakage to the main condenser. In accordance with the plant’s chemistry guidelines, an orderly plant shutdown was initiated, and subsequent repairs were made to the main condenser.

In 2011, the online noble chemistry durability coupon was analyzed to determine platinum deposition, and results were compared with industry data. The measured platinum deposition was 0.02 $\mu g/cm^2$ and is midrange within the industry database. Testing was performed to determine the optimum hydrogen water chemistry concentration.

An evaluation was performed in March 2012 to document the impact of October 2010 to March 2012 chemistry transients against vessel internals, Class 1 piping, and nuclear fuel. The evaluation concluded that the impact of the Fermi 2 chemistry transients on the RPV, vessel internals, stainless steel piping (such as recirculation piping), control rod blade components, and fuel components was negligible.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M2 was evaluated.

UFSAR Supplement. LRA Section A.1.43 provides the UFSAR supplement for the Water Chemistry Control – BWR Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Water Chemistry Control – BWR Program, the staff concludes 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant stated that the following AMPs are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- Bolting Integrity
- Boraflex Monitoring
- BWR Vessel Internals
- 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
- Oil Analysis
- Protective Coating Monitoring and Maintenance

- Reactor Head Studs
- Reactor Vessel Surveillance
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Service Water Integrity
- Structures Monitoring
- Water Chemistry Control – Closed Treated Water Systems
- Coating Integrity

For AMPs that the applicant claimed are consistent with the GALL Report, with exception(s) and/or enhancement(s), the staff performed an audit and review to confirm that those attributes or features of the program for which the applicant claimed consistency with the GALL Report are indeed consistent. The staff reviewed the exceptions to the GALL Report to determine whether they are acceptable and adequate. The staff also reviewed the enhancements to determine whether they will make the AMP consistent with the GALL Report AMP to which it is compared. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 Bolting Integrity

Summary of Technical Information in the Application. LRA Section B.1.2, as revised by letters dated January 20, 2015, and February 12, 2015, describes the existing Bolting Integrity Program as consistent, with exceptions and enhancements, with GALL Report AMP XI.M18, "Bolting Integrity." The LRA states that the AMP addresses safety-related and nonsafety-related accessible closure bolting of pressure-retaining components to manage the effects of loss of preload, cracking, and loss of material. The LRA also states that the AMP proposes to manage these aging effects through preventive actions and inspection activities, including using materials that have an actual yield strength that is less than 150 ksi, restricting the use of molybdenum disulfide (MoS_2) lubricant, applying an appropriate preload, and checking uniformity of gasket compression. The AMP also proposes to manage these aging effects through visual examinations made during periodic system walkdowns and inspections performed at least once per RFO. The AMP supplements the inspection activities required by ASME Code Section XI for ASME Code Class 1, 2, 3 bolting and uses the GALL Report recommended guidance in NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," dated June 1990; EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," dated April 1988; and EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," dated December 1995.

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 "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 an RAI, as discussed below.

The "parameters monitored or inspected" program element in GALL Report AMP XI.M18 recommends that "bolting for safety-related pressure retaining components [be] inspected for leakage, loss of material, cracking, and loss/of preload […]. Bolting for other pressure retaining components is inspected for signs of leakage." The "detection of aging effects" program element recommends that periodic inspections of pressure-retaining closure bolting should be performed at least once per refueling cycle for signs of leakage to ensure the detection of age-related degradation due to loss of material and loss of preload. During its audit, the staff found that the applicant's Bolting Integrity Program states that it "manages loss of preload, cracking, and loss of material for accessible closure bolting for safety-related and nonsafety-related pressure components." The LRA also states that periodic system walkdowns and inspections of accessible bolting will ensure the identification of loss of preload (leakage), cracking, and loss of material. The staff noted that GALL Report AMP XI.M18 does not make a distinction between accessible and inaccessible closure bolting in its recommendations to inspect and detect the effects of aging in closure bolts. The staff noted that there appeared to be a distinction made in the applicant's Bolting Integrity Program that the program would manage aging effects for accessible closure bolting. The staff could not determine whether the applicant planned also to manage the effects of aging on inaccessible pressure-retaining closure bolting within the scope of license renewal, consistent with the recommendations in the "parameters monitored or inspected" and "detection of aging effects" program elements of GALL Report AMP XI.M18. Therefore, by letter dated December 19, 2014, the staff issued RAI B.1.2-1 requesting that the applicant clarify whether the Bolting Integrity Program will manage the aging effects for inaccessible pressure-retaining closure bolting consistent with the recommendations in GALL Report AMP XI.M18. If inaccessible closure bolting would not be managed consistent with the recommendations in GALL Report AMP XI.M18, the staff also requested that the applicant explain what is considered inaccessible closure bolting and describe how the effects of aging will be adequately managed.

In its response dated January 20, 2015, the applicant stated that, for the management of the aging effects of safety-related and nonsafety-related pressure-retaining closure bolting under the Bolting Integrity Program, no distinction will be made between accessible and inaccessible bolting. The applicant also stated that closure bolting will be inspected for leakage, evidence of past leakage, and other signs of degradation during walkdowns and maintenance activities of systems within the scope of license renewal as recommended by GALL Report AMP XI.M18. The applicant also revised LRA Sections A.1.2 (UFSAR supplement); B.1.2; and Table A.4, "License Renewal Commitment List," Commitment No. 4, to remove the word "accessible" from the description and enhancements to the Bolting Integrity Program. The staff finds the applicant's response acceptable because it clarified that the Bolting Integrity Program will follow GALL Report AMP XI.M18 recommendations to inspect accessible and inaccessible closure bolting for loss of material, cracking, and loss of preload and to periodically inspect for leakage. The staff finds that this is consistent with the "parameters monitored or inspected," and "detection of aging effects" program elements of GALL Report AMP XI.M18. The staff's concern described in RAI B.1.2-1 is resolved.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "corrective actions," and "administrative controls" program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements follows.

Exception 1. LRA Section B.1.2 includes an exception to the "detection of aging effects" program element. In this exception the applicant stated that buried bolting in the fire water system "is inspected if excavated for maintenance or other activities." The exception includes a note stating that the bolting in the buried fire water system is only managed for loss of preload and that the Bolting Integrity Program has been effective in managing this aging effect through preventive measures that are taken before burial, including (1) verifying correct material,

(2) checking uniformity of the gasket compression after assembly, (3) using preventive coating, and (4) applying an appropriate preload. The staff reviewed LRA Section B.1.4, "Buried and Underground Piping," and LRA Section B.1.19, "Fire Water System," and noted that these AMPs will be consistent with the recommendations in GALL Report AMPs XI.M41, "Buried and Underground Piping and Tanks," and XI.M27, "Fire Water System," respectively. The staff's evaluation of the Buried and Underground Piping Program and Fire Water System Program are discussed in Sections 3.0.3.1.2 and 3.0.3.2.10, respectively. The staff noted that buried piping system bolting will be managed for loss of material under the new Buried and Underground Piping Program. Through the Buried and Underground Piping Program the applicant will perform visual examinations to detect the aging effect of loss of material in buried piping system bolting whenever the associated piping becomes accessible. The staff also noted that the existing Fire Water System Program continuously monitors the required operating pressure of the fire water system 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), and that corrective actions are taken whenever loss of system pressure is detected to ensure that the system maintains its intended function.

The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M18 and finds it acceptable because of the following three factors:

(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) As recommended by GALL Report AMP XI.M41, the buried bolts will be visually inspected for the aging effect of loss material through the Buried and Underground Piping Program.

(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 provide reasonable assurance that degradation associated to the buried bolts that may affect the system pressure (e.g., leakage) will be identified and that corrective actions will be taken before there is a loss of the intended function.

Exceptions 2 and 3. LRA Section B.1.2, as revised by letter dated February 12, 2015, includes two exceptions to the "detection of aging effects" program element. Exception 2 states that the lube oil pump bolting and other submerged bolting in the safety-related control center heating, ventilating, and air conditioning (CCHVAC) system, which has an external environment of lube oil, will be inspected during scheduled disassembly and PM activities. Exception 3 states that the nonsafety-related CTG system lube oil pump bolting and other submerged closure bolting in the lube oil sump will be inspected on an opportunistic basis. The staff noted that these are exceptions to GALL Report AMP XI.M18 recommendation to perform periodic inspections, at least once per RFO, of closure bolting to detect loss of material and loss of preload. The GALL Report Table XI.D, "Selected Definitions & Use of Terms for Describing and Standardizing Environments," states that steel, when exposed to lubricating oil with some water, will have limited susceptibility to aging degradation due to general or localized corrosion. Before the applicant's addition of these exceptions to the LRA, the staff identified concerns regarding how the program will be capable of detecting loss of material and loss of preload in the submerged bolts before a loss of intended function and, by letter dated January 14, 2015, issued RAI 3.3.2.9-1. The staff's concerns associated with RAI 3.3.2.9-1 are resolved, and SER Section 3.3.2.3.9 documents its discussion of these concerns. The staff reviewed these exceptions against the corresponding program element in GALL Report AMP XI.M18. Based on its review of the exceptions and information provided in the applicant's response to RAI 3.3.2.9-1, the staff finds Exceptions 2 and 3 acceptable because of the following:

- The Bolting Integrity Program has preventive actions in place, such as selection of materials and lubricants, application of the appropriate preload, and checking for uniformity of gasket compression, which are consistent with GALL Report AMP XI.M18 recommendations to prevent loss of material and loss of preload.
- As stated in the GALL Report, steel components exposed to lubricating oil have limited susceptibility to general and localized corrosion.
- The submerged closure bolts will be subject to opportunistic visual inspections under the Bolting Integrity Program, and these visual inspections will be capable of detecting the aging effects of loss material and loss of preload.
- As discussed in SER Section 3.3.2.3.9, the periodic monitoring of the lube oil pressure every 12 hours for the CCHVAC system pump and once a month for the CTG system pump in combination with the preventive actions taken and opportunistic inspections to be performed under the Bolting Integrity Program provide reasonable assurance that degradation associated to the submerged bolts will be identified and that corrective actions will be taken before there is a loss of intended function.

Enhancement 1. LRA Section B.1.2 includes an enhancement to the "preventive actions" program element. In this enhancement, the applicant stated that the Bolting Integrity Program procedures will be revised to make sure that, when high strength bolting material is acquired, its actual yield strength is considered and also to monitor acquired closure bolting of pressure-retaining components for cracking if its actual yield strength is greater than or equal to 150 ksi. 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. 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 "parameters monitored or inspected" (Enhancement 2) and "detection of aging effects" (Enhancement 3) program elements of the Bolting Integrity Program to monitor for cracking and perform volumetric examinations consistent with the ASME Code Section XI for closure bolting with actual yield strength greater 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, when implemented, the applicant will consider the actual yield strength of acquired high strength closure bolts and, if it is equal or greater than 150 ksi, will monitor the high strength closure bolts for cracking consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 2. LRA Section B.1.2, as revised by letter dated January 20, 2015, includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that the procedures of the Bolting Integrity Program will be revised to state that safety-related closure bolting for pressure-retaining components "is inspected for leakage, loss of material, and loss of preload/loss of prestress." The enhancement also states that closure bolting with actual yield strength greater or equal to 150 ksi will be monitored for cracking. The "parameters monitored or inspected" program element of GALL Report AMP XI.M18 recommends that safety-related closure bolting be inspected for leakage, loss of material, and loss of preload/loss of prestress. GALL Report AMP XI.M18 also recommends that high strength closure bolting with yield strength greater than or equal to 150 ksi should be monitored for cracking. 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 inspect for leakage, loss of material, and loss of preload/loss of prestress of safety-related closure bolting and will inspect for cracking of high strength closure bolting consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 3. LRA Section B.1.2, as revised by letter dated January 20, 2015, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the procedures of the Bolting Integrity Program will be revised to do the following: (1) implement the recommendations in NUREG-1339, EPRI NP-5769, and EPRI TR-104213 for closure bolting of pressure-retaining components, (2) state that ASME and non-ASME Code Class bolted connections will be inspected at least once per refueling cycle, and (3) include volumetric examination for closure bolting with actual yield strength greater or equal to 150 ksi, in accordance with ASME Code Section XI, Table IWB-2500-1, "Examination Categories," and regardless of code classification. The "detection of aging effects" program element of GALL Report AMP XI.M18 recommends bolting inspections to include the applicable guidance for pressure boundary bolting in NUREG-1339, EPRI NP-5769, and EPRI TR-104213. GALL Report AMP XI.M18 "detection of aging effects" program element also recommends periodic system inspections (at least once per RFO) of ASME Code and non-ASME Code Class bolting, as well as 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. 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 (1) include guidance from staff and industry documents for the inspection of closure bolting, (2) perform inspections of closure bolting at least once per RFO, and (3) perform volumetric inspection of high strength bolts, consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 4. LRA Section B.1.2 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the procedures of the Bolting Integrity Program will be revised to inspect, at least once every RFO, the RHR service water (RHRSW), emergency equipment service water (EESW), and emergency diesel generator service water (EDGSW) systems' pump and valve bolting submerged in the RHRSW reservoir. GALL Report AMP XI.M18 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. During its onsite review of the program basis documents, the staff noted that the program lacked information regarding how the inspections will detect the applicable aging effects on a submerged environment. The staff noted that a submerged environment limits the ability to detect leakage of submerged bolted connections; therefore, it is not clear how the program will detect loss of material and loss of preload in the submerged bolted connections before a loss of intended function. By letter dated December 19, 2014, the staff issued RAI B.1.2-2 requesting that the applicant describe how the program will detect loss of material and loss of preload in the submerged closure bolts within the scope of license renewal. The staff also requested that the applicant describe how the proposed bolting inspections will detect loss of material in crevice locations (e.g., threaded regions or the shank below the bolt heads) that are not readily visible.

In its response dated January 20, 2015, the applicant stated that the loss of material and loss of preload aging effects in the submerged bolts will be adequately managed through the following activities:

- The applicant will take preventive measures that are consistent with the GALL Report, such as selecting material and lubricants, applying an appropriate preload, and checking for uniformity of the gaskets compression to reduce the potential of the aging effects.
- The applicant will perform periodic visual inspections of the submerged bolting. Based on the applicant's operating experience, these visual inspections, using divers, have been capable of detecting both loss of material and loss of preload and have resulted in corrective actions taken (e.g., bolt replacement, selection of new bolting material, and changes to service water chemical addition process to reduce corrosion) before a loss of intended function.
- Trending of pump performance parameters during quarterly surveillance runs of the RHRSW, EESW, and EDGSW pumps would result in corrective actions being taken when there is pump degradation. Corrective actions would lead to pump maintenance (i.e., repair or refurbishment), during which the associated bolting, including bolting threads, would be inspected.

As part of its response, the applicant also revised LRA Sections A.1.2, A.4 (Commitment No. 4), and B.1.2 to state that its enhancement (Enhancement 4) to the Bolting Integrity Program "detection of aging effects" program element will also include a revision to the AMP procedures to opportunistically inspect the threads of the submerged bolting in the RHRSW reservoir during maintenance activities. The staff reviewed the applicant's response and noted that an opportunistic inspection approach may result in inspections not being done frequently enough to detect degradation of the bolt thread area of the submerged bolts before there is a loss of intended function or possibly not being done at all if no opportunity arises. SRP-LR Section A.1.2.3.10 states that the AMP frequency of inspections may be linked to plant-specific or industry wide 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 needed additional information to understand how opportunistic inspections based on pump maintenance activities will be adequate to detect loss of material in the thread region of the submerged bolts before there is a loss of intended function. Therefore, by letter dated April 2, 2015, the staff issued followup RAI B.1.2-2a requesting that the applicant provide the following information:

(1) the number of times (including year) that maintenance activities (e.g., pump repair or refurbishment) have been performed for the RHRSW, EESW, and EDGSW systems with submerged bolting

(2) the technical basis as to how the proposed inspections will ensure that the aging effects for the threaded area of the submerged bolting will be detected in a timely manner and will be adequately managed before there is a loss of intended function

By letter dated April 27, 2015, the applicant provided its response to followup RAI B.1.2-2a. In its response to RAI B.1.2-2a, Part (1), the applicant provided the maintenance history for the pumps with submerged bolting by stating the following:

- The RHRSW system pumps A, B, C, and D were replaced once in November 2005, July 2009, April 2010, and March 2011, respectively.
- The EESW system pumps A and B were replaced once in February and October 2006, respectively.

- The EDGSW system pumps 11, 12, 13, and 14 were replaced once in November 2008, February 2005, May 2008, and October 2007, respectively.

The applicant also stated that, although the systems' pumps had no other significant repair or refurbishment, periodic inspections have resulted in corrective actions taken involving the replacement of individual submerged bolts. In Part (2) of the response the applicant stated that the current periodic inspections are capable of visually inspecting the head and exposed threads of some bolts. The applicant stated that because a portion of the bolt threads protrude beyond the flange, it is possible to perform visual inspections of those bolt thread areas. These visual inspections will be performed every RFO during the period of extended operation. In its response, the applicant provided photographs showing the configuration of a bolt joint connection with bolt threads protruding from the joint. The photographs also showed an example of the degradation found on a bolt. The applicant stated that degradation of the bolt heads and exposed threads have been identified through visual inspections and that corrective actions were taken to remove and replace the bolts. The applicant also stated the following:

> Visual inspection of the degraded bolts after their removal has indicated that the worst degradation occurs on the bolt head and threads that are exposed. […]. As a result, the exposed bolt head and threads that are visually inspected on a periodic basis provide the leading indication of degradation and bound the condition of the bolt threads in the non-exposed, load-bearing portion of the bolts (i.e., inside the flange). For this reason, aging effects in the threaded area of the submerged bolting will be detected in a timely manner and adequately managed prior to loss of intended function. When degradation of the exposed bolting is discovered during periodic inspections, the bolting will be replaced in accordance with the corrective action program […].

The applicant further stated that maintenance activities of the RHRSW, EESW, and EDGSW pumps have been done at least once in the first 25 years of plant operation; therefore, "it is expected that pump maintenance will occur again during the period of extended operation." During this maintenance, the applicant will opportunistically inspect the submerged bolting, including the bolt threads in the non-exposed region.

The staff finds the enhancement and applicant responses to RAIs B.1.2-2 and B.1.2-2a acceptable because of the following:

- Preventive actions, such as selecting material and lubricants, applying an appropriate preload, and checking for uniformity of the gaskets compression, will be taken consistent with GALL Report AMP XI.M18 recommendations to minimize the potential of loss of preload and lubricant-related degradation.
- Periodic visual inspections of the leading areas of submerged bolting degradation (i.e., bolt head and exposed bolt threads) at Fermi 2 are capable of detecting loss of material and loss of preload and will be performed at least once every RFO consistent with GALL Report AMP XI.M18 recommendations.
- Monitoring and trending of pump performance parameters during quarterly surveillance runs can result in the detection of age-related degradation of the submerged bolting.
- Based on the applicant's operating experience associated with the maintenance activities of the pumps, it is likely that the opportunistic inspection of the bolts, including

the non-exposed area of the bolt threads, will be performed at least once during the period of extended operation.

- The staff has reasonable assurance that the combination of activities described above are able to detect and adequately manage the aging effects for the submerged bolts in the RHRSW, EESW, and EDGSW systems before there is a loss of intended function.

The staff's concerns associated to RAIs B.1.2-2 and B.1.2-2a are resolved.

Enhancement 5. LRA Section B.1.2 includes an enhancement to the "corrective actions" program element. In this enhancement, the applicant stated that the procedures of the Bolting Integrity Program will be revised to include the recommendations in EPRI NP-5769 and EPRI TR-104213 for the replacement of ASME Code Class bolting and other (i.e., non-ASME Code Class) pressure-retaining bolting, respectively. The "corrective actions" program element of GALL Report AMP XI.M18 recommends using the additional guidance of EPRI NP-5769 for the replacement of ASME Code pressure-retaining bolting and using the guidelines of EPRI TR-104213 for the replacement of other pressure-retaining bolting. 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 procedures will incorporate the guidance in EPRI NP-5769 and EPRI TR-104213 for the replacement of ASME and non-ASME Code Class pressure-retaining bolting, consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 6. LRA Section B.1.2 includes an enhancement to the "administrative controls" program element. In this enhancement, the applicant stated that the procedures of the Bolting Integrity Program will be revised "to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR [Part] 50 Appendix B Quality Assurance Program." The "administrative controls" program element of GALL Report AMP XI.M18 states that the requirements of Appendix B to 10 CFR Part 50 are acceptable to address the administrative controls. 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 administrative controls of the Bolting Integrity Program will be in accordance with Appendix B to 10 CFR Part 50, consistent with the recommendations in GALL Report AMP XI.M18.

Enhancements 7 and 8. LRA Section B.1.2, as revised by letter dated February 12, 2015, includes an enhancement to the "detection of aging effects" program element. In Enhancement 7, the applicant stated that to ensure that loss of material in crevice locations can be detected, the AMP procedures will be revised to ensure that loss of material in crevice locations can be detected and to perform opportunistic inspections of the CCHVAC system safety-related closure bolting, including the bolting threads, exposed to a lube oil environment. In Enhancement 8, the applicant stated that the AMP procedures will be revised to "perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment."

The staff noted that GALL Report Table IX.D states that steel, when exposed to lubricating oil with some water, will have limited susceptibility to aging degradation due to general or localized corrosion. Before the applicant's addition of these enhancements to the LRA, the staff identified concerns regarding how the program will be capable of detecting loss of material and loss of preload in the submerged bolts before a loss of intended function and, by letter dated January 14, 2015, issued RAI 3.3.2.9-1 to request additional information. The staff's concerns associated with RAI 3.3.2.9-1 are resolved, and SER Section 3.3.2.3.9 documents its discussion of these concerns.

The staff reviewed Enhancements 7 and 8 against the corresponding program element in GALL Report AMP XI.M18. Based on its review of the enhancements and information provided in the applicant's response to RAI 3.3.2.9-1, the staff finds Enhancements 7 and 8 acceptable because of the following:

- The Bolting Integrity Program has preventive actions in place, such as selecting material and lubricants, applying an appropriate preload, and checking for uniformity of the gaskets compression, that are consistent with GALL Report AMP XI.M18 to prevent loss of material and loss of preload.
- As stated in the GALL Report, steel components exposed to lubricating oil have limited susceptibility to general and localized corrosion.
- The submerged closure bolts will be subject to opportunistic visual inspections under the Bolting Integrity Program, and these visual inspections will be capable of detecting the aging effects of loss of material and loss of preload.
- As discussed in SER Section 3.3.2.3.9, the periodic monitoring of the lube oil pressure every 12 hours for the CCHVAC system pump and once a month for the CTG system pump, in combination with the preventive actions taken and opportunistic inspections that will be performed under the Bolting Integrity Program, provides reasonable assurance that degradation associated to the submerged bolts will be identified and that corrective actions will be taken before there is a loss of the intended function.

Based on its audit and review of the applicant's responses to RAIs B.1.2-1, B.1.2-2, B.1.2-2a, and 3.3.2.9-1, 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.M18. The staff also reviewed the exceptions associated with the "detection of aging effects" program element and their justification 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 "preventive actions," "parameters monitored or inspected," "detection of aging effects," "corrective actions," and "administrative controls" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.2 summarizes operating experience related to the Bolting Integrity Program. The LRA states that, in 2003, during a dive inspection of the RHR reservoir, divers identified corroded bolts on the flanges of all Division 1 RHR complex service water pumps. Corrective actions were taken to (1) replace the submerged bolts, (2) establish a PM activity for pump refurbishment or replacement that includes the selection of new material for replacement bolts, and (3) change the chemical addition process to reduce corrosion. The LRA also states that, during an ISI, loose bolting was discovered on a pressure valve seal bonnet. The applicant, consistent with IWB-2430, expanded the sample size to bolting in 13 additional valves and found loose bolting in the seal bonnet of a second valve. The applicant entered the issue in its corrective action program, repaired the leaking valve bonnets, and revised the post-maintenance testing to ensure that pressure valves bolting torque requirements were met. A 2007 followup review of the pressure valves found no reoccurrence of loose bolts.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff 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 due to its potential contribution to 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 reviewed the AMP basis documents and 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 Fermi 2 before plant procedures were revised to prohibit their use. By letter dated December 19, 2014, the staff issued RAI B.1.2-3 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 January 20, 2015, the applicant stated that the use of MoS_2 has been restricted by its chemical control procedure since May 27, 1997. The applicant also stated that bolting maintenance procedures, including an original procedure dating back to 1983 (before plant startup) required that bolts be cleaned of old lubricant, inspected, and lubricated with Fel Pro N-5000, N-7000, Dag Dispersion 156, and other lubricants, none of which contain MoS_2. Pipe erection specifications, dating back to May 1975 and used during plant construction, required the use of specific lubricants (e.g., Fel Pro N-5000, N-7000, Dag Dispersion 156, and Crane Company screw thread lubricant) that did not contain MoS_2. The applicant further stated that its maintenance procedure references NUREG-0943, "Threaded Fastener Experience in Nuclear Power Plants," dated January 1983, which discusses the bolting degradation and failures caused by MoS_2. The staff finds the applicant's response acceptable because maintenance procedures and pipe specifications used during construction and maintenance at Fermi 2 did not prescribe the use of MoS_2 lubricants; therefore, there is reasonable assurance that the adverse degradation effects (e.g., SCC) in high strength bolts that can be caused by the use of MoS_2 lubricants will not be present at Fermi 2. The staff's concern described in RAI B.1.2-3 is resolved.

Based on its audit and review of the application and review of the applicant's response to RAI B.1.2-3, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M18 was evaluated.

UFSAR Supplement. LRA Section A.1.2 provides the UFSAR supplement for the Bolting Integrity Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 4) to implement the enhancements to the program 6 months before the period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letters dated January 20, 2015, and February 12, 2015, 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 exceptions and their justification and determines that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Boraflex Monitoring

Summary of Technical Information in the Application. LRA Section B.1.3, as amended by applicant letters through September 24, 2015, originally described the existing Boraflex Monitoring Program as consistent, with an enhancement, with GALL Report AMP XI.M22, "Boraflex Monitoring." The LRA originally stated that (a) the AMP manages the aging effect of reduction in neutron-absorbing capacity in the Boraflex material affixed to spent fuel racks, (b) the AMP is implemented to ensure that no unexpected degradation of the Boraflex material compromises the criticality analysis in support of the design of spent fuel storage racks, and (c) that the AMP uses the RACKLIFE computer predictive code to calculate the gamma dose absorbed by, and the amount of boron carbide loss from, the Boraflex panels. The AMP originally included (1) quarterly sampling and analysis for silica levels in the spent fuel pool water and trending of the results by using the RACKLIFE code, (2) performing periodic physical measurements and neutron attenuation testing of surveillance coupons, and (3) areal boron 10 density measurement testing of the spent fuel storage racks, such as BADGER testing, at a frequency of at least once every 5 years. As described below, by letter dated September 24, 2015, the applicant withdrew crediting of this AMP and committed to not rely on Boraflex panels in the spent fuel pool for neutron absorption during the period of extended operation.

Staff Evaluation. In a letter dated September 24, 2015, the applicant provided supplemental information on the continued use of the Boraflex material in the Fermi 2 spent fuel pool. The applicant stated that the Boraflex currently used in the spent fuel racks will not be credited for neutron absorption during the period of extended operation. Accordingly, the Boraflex Monitoring Program will not be relied on during the period of extended operation. The applicant revised LRA Sections A.1.3 and B.1.3 to no longer credit the Boraflex material or the Boraflex Monitoring Program for the period of extended operation. The applicant stated that all neutron-absorbing materials in the spent fuel pool will be managed during the period of extended operation by the Neutron Absorbing Material Monitoring Program AMP. The staff's review of this AMP is in SER Section 3.0.3.2.15.

Operating Experience. LRA Section B.1.3 originally provided operating experience related to the Boraflex Monitoring Program, which was subsequently deleted by the applicant in its September 24, 2015, letter. The staff's evaluation of this operating experience follows below in order to provide more details of the staff's review and the issues addressed.

- In 2013, the applicant performed BADGER testing on 60 Boraflex panels in the spent fuel pool. Three panels were reported to have fallen below the acceptance criteria limit. The applicant conducted a criticality sensitivity analysis to determine the margin needed to maintain the required 5-percent subcriticality margin. The applicant took actions to preclude placing fuel in the cells adjacent to the three panels. A corrective action document was written to evaluate impacts of the BADGER testing results on the Boraflex Monitoring Program.
- In 2012, the LRA states that NRC Information Notice (IN) 2012-13, "Boraflex Degradation Surveillance Programs and Corrective Actions in the Spent Fuel Pool," dated August 10, 2012, was reviewed regarding surveillance programs and corrective actions at Turkey Point Nuclear Generating Station and Peach Bottom Atomic Power Station with regards to Boraflex degradation monitoring. Based on the review, revisions were made to RACKLIFE inputs to ensure that the model will provide more conservative calculations.
- In 2011, coupon testing was performed on four Boraflex surveillance coupons at Pennsylvania State University. The LRA indicated that the coupons satisfied all applicable test criteria.
- In 2009, the applicant observed that the silica level in the spent fuel pool was above that observed in previous cycles. Preparations were initiated to perform BADGER testing, which was performed in 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.

During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

In a letter dated December 23, 2014, the staff issued RAI B.1.3-1, which requested that the applicant provide the 2013 BADGER test report to the staff for review and assessment of the condition of the Boraflex material and the effectiveness of the Boraflex Monitoring Program.

In a letter dated January 26, 2015, the applicant provided the 2013 BADGER test report to the staff. The staff reviewed the 2013 report and determined that further information was needed to determine whether the program provides reasonable assurance that it can detect unexpected degradation of the Boraflex material in the spent fuel pool. In a letter dated March 13, 2015, the staff issued RAI B.1.3-1a, which requested that the applicant provide clarification on the information provided in the 2013 BADGER test report.

In a letter dated April 10, 2015, the applicant provided supplemental information on the Boraflex Monitoring Program. In the stated letter, the applicant references several documents/reports that are the basis for its discussion on the acceptable use and performance of the Boraflex material (i.e., a sensitivity study, criticality safety analysis, and Boraflex degradation projection). The staff reviewed the April 10, 2015, letter and determined that further information was needed. On August 17, 2015, the staff held a conference call with the applicant to discuss the applicant's long-term strategy to provide reasonable assurance that it will be able to manage Boraflex degradation and to maintain the spent fuel pool subcriticality requirements.

In a letter dated September 24, 2015, the applicant provided supplemental information on the continued use of the Boraflex material in the Fermi 2 spent fuel pool. The applicant stated that the Boraflex currently used in the spent fuel racks will not be credited for neutron absorption during the period of extended operation. The applicant also indicated that the Boraflex Monitoring Program will not be relied on during the period of extended operation. The applicant further noted that the Neutron Absorbing Material Monitoring Program will be used to manage all the neutron-absorbing material that will be credited during the period of extended operation (including, but not limited to, Boral). The applicant revised LRA Sections 2.3.3.4, 3.3.2.1.4, A.1.3, B.1.3, and LRA Tables 3.3.1 (item 3.3.1-51), 3.3.2-4, A.4 (item 5), B-1, B-2, and B-3 to no longer credit the Boraflex material or the Boraflex Monitoring Program for the period of extended operation. The applicant committed (Commitment No. 5) to not require the current Boraflex panels in the spent fuel pool to perform a neutron-absorption function during the period of extended operation.

The staff reviewed this letter and finds the revisions regarding Boraflex acceptable because the applicant will discontinue reliance on the Boraflex neutron-absorbing material during the period of extended operation. In addition, the staff reviewed Commitment No. 5 and finds it acceptable because the applicant has identified that the Boraflex material is degrading and that the techniques used to determine the rate of degradation do not correlate well. Hence, the reliability of the Boraflex material to perform its intended function during the period of extended operation cannot be accurately projected or managed. The staff's concerns described in RAI B.1.3-1 and RAI B.1.3-1a are resolved.

UFSAR Supplement. LRA Section A.1.3 provides the UFSAR supplement for the Boraflex Monitoring Program. In its letter dated September 24, 2015, the applicant provided supplemental information stating that the Boraflex currently used in the spent fuel racks will not be credited for neutron absorption during the period of extended operation. The applicant also indicated that the Boraflex Monitoring Program will not be relied on during the period of extended operation. The applicant stated that all neutron-absorbing materials in the spent fuel pool will be managed during the period of extended operation by the Neutron Absorbing Material Monitoring Program AMP. The applicant revised LRA Section A.1.3 to no longer credit the Boraflex material or the Boraflex Monitoring Program for the period of extended operation.

The staff reviewed the revisions to the UFSAR supplement regarding the Boraflex Monitoring Program and Commitment No. 5 and finds the changes acceptable because the applicant will discontinue reliance on the Boraflex neutron-absorbing material during the period of extended operation. The staff also noted that the applicant committed to implement Commitment No. 5 before September 20, 2024, or the end of the last RFO before March 20, 2025.

Conclusion. In its letter dated September 24, 2015, the applicant provided supplemental information stating that the Boraflex currently used in the spent fuel racks will not be credited for neutron absorption during the period of extended operation. The applicant also indicated that the Boraflex Monitoring Program will not be relied on during the period of extended operation. The applicant stated that all neutron-absorbing materials in the spent fuel pool will be managed during the period of extended operation by the Neutron Absorbing Material Monitoring Program AMP. The staff's review of the acceptability of this AMP is in SER Section 3.0.3.2.15. The applicant revised LRA Section B.1.3 to no longer credit the Boraflex material or the Boraflex Monitoring Program for the period of extended operation. The staff reviewed the changes and finds the revisions regarding the Boraflex neutron-absorbing material acceptable because the applicant will discontinue reliance on the Boraflex during the period of extended operation.

3.0.3.2.3 BWR Vessel Internals

Summary of Technical Information in the Application. LRA Section B.1.10 describes the existing BWR Vessel Internals Program as consistent, with enhancements, with GALL Report AMP XI.M9, "BWR Vessel Internals." The BWR Vessel Internals Program addresses BWR vessel internal components to manage cracking, loss of material due to wear, and reduction of fracture toughness through inspection and flaw evaluation. The LRA states that the program's inspection schedule, aging effect detection, NDE inspection techniques, acceptance criteria, flaw evaluation, and repair/replacement corrective actions are based on applicable industry standards and NRC-approved BWRVIP documents. Three enhancements to the BWR Vessel Internals Program will be implemented before the period of extended operation, and no exceptions will be taken.

LRA Appendix C lists the following BWRVIP reports that are credited for the BWR Vessel Internals Program that have NRC safety evaluations for license renewal:

- BWRVIP-14-A, "Evaluation of Crack Growth in BWR Stainless Steel RPV Internals"
- BWRVIP-18-A, Revision 2, "BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines," (Updated to Revision 2 in the annual update of May 9, 2016)
- BWRVIP-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines"
- BWRVIP-26-A, "BWR Top Guide Inspection and Flaw Evaluation Guidelines"
- BWRVIP-27-A, "BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines"
- BWRVIP-38, "BWR Shroud Support Inspection and Flaw Evaluation Guidelines"
- BWRVIP-41, Revision 3, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines"
- BWRVIP-47-A, "BWR Lower Plenum Inspection and Flaw Evaluation Guidelines"
- BWRVIP-48-A, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines"
- BWRVIP-49-A, "Instrument Penetration Inspection and Flaw Evaluation Guidelines"
- BWRVIP-74-A, "BWR Reactor Vessel Inspection and Flaw Evaluation Guidelines"
- BWRVIP-76, Revision 1-A, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines" (Updated to Revision 1-A in the annual update of May 9, 2016)
- BWRVIP-100-A, "Updated Assessment of Fracture Toughness of Irradiated Stainless Steel for BWR Core Shroud"

LRA Appendix C also contains the applicant's responses to license renewal action items that were identified in the NRC's safety evaluations for the applicable BWRVIP reports. The responses include three license renewal action items applicable to all BWRVIP reports and several other license renewal action items applicable to specific BWRVIP reports. The staff's evaluation of the applicant's responses to these action items are documented in the staff evaluation section for this AMP.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M9.

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 recommendations in GALL Report AMP XI.M9, "BWR Vessel Internals," state that the CRD housing and lower plenum components are subject to the guidelines in BWRVIP-47-A for inspection and evaluation (I&E). GALL Report AMP XI.M9 also states that BWRVIP-58-A provides guidelines for the repair design criteria of the CRD housing and that BWRVIP-57-A provides guidelines for the repair design criteria of the lower plenum components. However, during the AMP audit, the staff noted that the program documents reference BWRVIP-58-A and BWRVIP-57-A as guidelines for the repair design criteria of the CRD housing and the lower plenum components. The program also references BWRVIP-55-A as repair design criteria guidelines for these components. However, the plant procedures only reference BWRVIP-55-A. The staff was unclear about the inconsistency in the plant documents regarding these guidelines. By letter dated December 17, 2014, the staff issued RAI B.1.10-1 requesting that the applicant (a) identify the specific BWRVIP guidelines that are being used for repairs of the CRD housings and the lower plenum components in the plant design, (b) clarify whether these guidelines are within the scope of the BWR Vessel Internals Program for the LRA and whether the guidelines have been incorporated into the specific plant procedure that will be used to implement the BWR Vessel Internals Program during the period of extended operation, and (c) identify any additional BWRVIP guidelines being relied on for the BWR Vessel Internals Program beyond those in GALL Report AMP XI.M9 and provide any applicable license renewal applicant action items (AAIs).

In its response dated January 20, 2015, the applicant stated that the plant uses BWRVIP-55-A, BWRVIP-57-A, and BWRVIP-58-A as guidelines for the repair design criteria of the CRD housing and the lower plenum components. In its response, the applicant also provided a list of the BWRVIP reports that the plant implements that contain "mandatory" or "needed" guidance. The applicant also confirmed that all of the BWRVIP guidelines with license renewal AAIs have been identified in LRA Appendix C, including responses.

The staff finds the applicant's response acceptable because the applicant clarified which BWRVIP guidelines are used for the repair design criteria of the CRD housing and the lower plenum components and because it will update its plant procedures appropriately. The applicant also confirmed that all applicable BWRVIP license renewal AAIs have been provided in the LRA. The staff's concern described in RAI B.1.10-1 is resolved.

The staff also reviewed the portions of the "detection of aging effects" program element 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.

Enhancements 1 and 2. LRA Section B.1.10 includes Enhancement 1 to the "detection of aging effects" program element. In this enhancement, the applicant stated that the susceptibility to neutron and thermal embrittlement for reactor vessel internal components composed of CASS and X-750 alloy will be evaluated.

LRA Section B.1.10 includes Enhancement 2 to the "detection of aging effects" program element. In this enhancement, the applicant stated that BWR Vessel Internals Program procedures will be revised as follows:

> Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within five years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations

The staff reviewed Enhancement 1 against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because, when it is implemented, it will manage the effects of neutron and thermal embrittlement of CASS and X-750 alloy reactor vessel internal components consistent with the recommendations in the GALL Report to ensure that the intended functions will be maintained during the period of extended operation.

The staff reviewed Enhancement 2 against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable (a) because it provides the details of how the susceptibility evaluation in Enhancement 1 will be performed and (b) because, when it is implemented, it will ensure that susceptible vessel internals components will be inspected for evidence of any cracking that could cause failure due to the loss of the material's fracture toughness caused by thermal or neutron embrittlement. The staff confirmed that when Enhancements 1 and 2 are implemented in conjunction with each other, the applicant's basis will be consistent with the "detection of aging effects" program element in GALL Report AMP XI.M9.

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 BWR Vessel Internals Program procedures will be revised as follows:

> In accordance with an applicant action item for BWRVIP-25 safety evaluation:
> (a) install core plate wedges prior to the period of extended operation, or
> (b) complete a plant-specific analysis that justifies no inspections are required or to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25 and submit the inspection plan, along with the acceptance criteria and justification for the inspection plan, to the NRC two years prior to the period of extended operation.

By letter dated April 27, 2015, the applicant amended Enhancement 3. This amendment was a result of the staff's evaluation of the applicant's response to Action Item 4 in BWRVIP-25, as documented in the section entitled, "Review of License Renewal Applicant Action Items – Appendix C," of this evaluation. The staff reviewed Enhancement 3 against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because (a) it ensures that an analysis justifying its inspection basis or elimination of inspections will be submitted to the NRC and (b) it ensures that loss of preload/stress relaxation in the core plate rim hold-down bolts will be managed during the period of extended operation. The staff confirmed that when

Enhancement 3 is implemented, the applicant's basis will be consistent with the "detection of aging effects" program element in GALL Report AMP XI.M9.

Enhancement 4. LRA Section B.1.10, as amended by letter dated June 9, 2015, includes an enhancement to the "detecting of aging effects" and "corrective actions" program elements. This enhancement was added to the BWR Vessel Internals Program as a result of the applicant's response to RAI B.1.10-3, as documented in the staff's evaluation of the applicant's response to Action Item 4 in BWRVIP-26-A in the section entitled, "Review of License Renewal Applicant Action Items – Appendix C," of this evaluation. The enhancement states that the BWR Vessel Internals Program procedures will be revised to include how the three conditions/limitations associated with BWRVIP-183 are addressed to justify its use of the flaw evaluation methodology. The staff reviewed Enhancement 4 against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because the applicant addressed the three conditions/limitation of the use of BWRVIP-183 and justified that it will conservatively account for stress loads for potential flaws near component discontinuities, flaw growth assumptions, and severed beam locations such that the flaw evaluation methodology will not be negatively impacted.

Enhancement 5. LRA Section B.1.10, as amended by letter dated August 20, 2015, includes an enhancement to the "detecting of aging effects" program element. This enhancement was added to the BWR Vessel Internals Program as a result of the applicant's supplemental response to RAI 4.1-4a, as documented in the staff's evaluation of the applicant's response to Action Item 4 in BWRVIP-27-A in the section entitled, "Review of License Renewal Applicant Action Items – Appendix C," of this evaluation. The enhancement states that the BWR Vessel Internals Program procedures will be revised to perform opportunistic inspections of the differential pressure and SLC line inside the reactor vessel when the line becomes accessible. The staff reviewed Enhancement 4 against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because these inspections will be performed in addition to the aging management activities of the Water Chemistry Control – BWR Program and One-Time Inspection Program to provide additional assurance that cracking will be detected and appropriate corrective actions will be performed before loss of intended function.

Based on its audit and review of the applicant's response to RAI B.1.10-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M9. In addition, the staff reviewed the enhancements associated with the "detection of aging effects" program element and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Review of License Renewal Applicant Action Items – Appendix C: The LRA references the BWRVIP reports, which have been reviewed and approved by the staff, as part of its AMPs for the reactor vessel and its internal components. As part of the staff's approval of these BWRVIP reports, the staff's safety evaluations on the reports included a number of AAIs that were to be addressed as part of the basis for applying the reports to the CLB. Those BWR applicants applying for license renewal of their facilities were requested to include their responses to the AAIs items in their LRAs.

Several of BWRVIP documents credited for Fermi 2 license renewal have common action items in the NRC safety evaluation reports for license renewal. The applicant provided the following responses to the three common license renewal action items:

(1) Fermi’s AMP for the reactor vessel internal components is bounded by the BWRVIP reports.

(2) The UFSAR supplement addresses a summary of the programs and activities specified in the applicable BWRVIP reports.

(3) Fermi 2 states that no TS changes have been identified as a result of implementing the AMP for the reactor vessel internal components.

For the first common license renewal action item, the staff confirmed that the BWRVIP reports incorporated by the applicant bound the BWR Vessel Internals Program.

For the second common license renewal action item, the staff verified that the LRA includes a UFSAR supplement summary description (LRA Section A.1.10) for the BWR Vessel Internals Program and that the summary description adequately explains how the applicable BWRVIP inspection, evaluation, and repair criteria reports will be used to manage aging in the reactor internals at Fermi 2, Unit 2.

For the third common license renewal action item, the staff confirmed that the applicant would not need to add any new TS requirements for the reactor internals or to modify any existing TS requirements that may apply to reactor internal components.

In addition to these three common action items, the LRA provides the applicant’s responses to the report-specific license renewal action items that were specified by the staff in its safety evaluation reports for BWRVIP reports credited for the BWR Vessel Internals Program. The following paragraphs address the staff’s evaluation of the applicant’s responses to these report-specific action items.

For Action Item 4 in BWRVIP-18-A, Revision 1, the applicant is requested to identify and evaluate any potential TLAA issues that may impact the structural integrity of the subject reactor pressure vessel internal components. The applicant’s response states that TLAA issues were identified and evaluated for core spray components that are part of the reactor vessel internals, which is discussed in LRA Section 4.3.1.4. The staff evaluated the applicant’s TLAA for managing the effects of fatigue on the reactor vessel internals, as discussed in LRA Section 4.3.1.4, and finds the applicant’s response to the action item acceptable. The staff’s evaluation of LRA Section 4.3.1.4 is documented in SER Section 4.3.1.4.

In the applicant’s annual update of May 9, 2016, the applicant updated the version of BWRVIP-18 being used for the core spray lines to BWRVIP-18, Revision 2, and indicated that the response to Action Item 4 is applicable to this version of the BWRVIP report. The staff noted that BWRVIP-18, Revision 2, was approved in an NRC safety evaluation dated February 22, 2016 (ADAMS Accession No. ML16011A190). The staff also noted that use of BWRVIP-18, Revision 2, would not alter the applicant’s response basis for Action Item 4 above because the metal fatigue TLAA for the core spray lines is still applicable to the plant design and the methodology in BWRVIP-18, Revision 2. Therefore, based on this review, the staff finds the use of BWRVIP-18, Revision 2, to be acceptable because: (a) the report has been approved in the referenced safety evaluation, and (b) the applicant’s basis for resolving Action Item 4 remains within the scope of the plant design and the approved methodology in BWRVIP-18, Revision 2. The staff evaluates the fatigue TLAA-related action items for the core spray lines in SER Section 4.1.

For Action Item 4 in BWRVIP-25, the applicant is requested to identify and evaluate the projected stress relaxation of the rim hold-down bolts as a potential TLAA issue. The applicant's response states that the BWR Vessel Internals Program will be enhanced to either (a) install core plate wedges or (b) submit an inspection plan and acceptance criteria analysis to the staff. The response also states that the analysis of loss of preload on the rim hold-down bolts is not a TLAA because it does not involve time-limited assumptions defined by the current term of operation. The staff's evaluation of the applicant's determination that this analysis was not a TLAA is documented in SER Section 4.1. The staff noted concerns regarding Option (b) of the proposed enhancement and issued RAI 4.1-2, by letter dated December 23, 2014, requesting that the applicant provide further clarifications and justifications relative to Option (b) of the proposed enhancement.

By letter dated February 5, 2015, the applicant responded to RAI 4.1-2. In its response, the applicant amended the enhancement to clarify how it would implement the enhancement and commitment as part of the CLB. However, the staff noted that under the amendment of this commitment, the applicant would only need to submit an inspection plan to the NRC for approval if the EPRI BWRVIP's future updated I&E guideline bases for BWR core plate rim hold-down bolts would continue to call for inspections of these components. The staff's full evaluation of the applicant's response to RAI 4.1-2 is documented in SER Section 4.1. The staff determined that the amended enhancement did not provide an adequate basis for managing loss of preload/stress relaxation in the core plate rim hold-down bolts because (a) the proposed action in the option is based on the applicant's speculation that the BWRVIP will be updating its inspection guidance for core plate rim hold-down bolts, which has yet to be done (including proper regulatory review by the NRC), and (b) the proposed action in the option does not indicate that the inspection plan for the core plate rim hold-down bolts, along with the supporting loss of preload/stress relaxation analysis and justification, will be submitted to the NRC for staff approval at least 2 years before entering into the period of extended operation, regardless of whether inspections of the bolts will be implemented or eliminated in the updated I&E guidelines for the components.

By letter dated March 26, 2015, the staff issued RAI B.1.10-2 (followup to RAI 4.1-2), requesting that the applicant address the staff's issues with the aging management basis in Option (b) of the enhancement to the BWR Vessel Internals Program. Specifically, the staff asked the applicant to justify why the amended enhancement did not firmly commit to submittal of an inspection plan of the core plate rim hold-down bolts, along with a supporting loss of preload/stress relaxation analysis and justification, for NRC approval at least 2 years before entering into the period of extended operation, regardless of whether the submitted basis proposes inspections or justifies elimination of inspections for the core plate rim hold-down bolts.

By letter dated April 27, 2015, the applicant responded to RAI B.1.10-2. The applicant amended the enhancement to state the following:

(a) install core plate wedges prior to the period of extended operation, or

(b) complete a plant-specific analysis that justifies no inspections are required, or

(c) complete a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25.

This amendment is reflected in LRA Sections B.1.10, A.1.10 and A.4 and in LRA Appendix C. The applicant further stated that the analysis performed under Option (b) or (c) of this enhancement will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and will quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation and that it will be submitted to the NRC 2 years before entering the period of extended operation. The applicant also stated that it will determine whether the analysis will meet the criteria for a TLAA and that it will revise the UFSAR accordingly 2 years before entering the period of extended operation. The staff finds the applicant's response acceptable because the amended enhancement will ensure that an analysis justifying its inspection basis or elimination of inspections will be submitted to the NRC. The staff has reasonable assurance that loss of preload/stress relaxation in the core plate rim hold-down bolts will be managed during the period of extended operation. The staff's concerns in RAI B.1.10-2 are resolved. Therefore, the staff finds the applicant's response to Action Item 4 in BWRVIP-25 acceptable.

For Action Item 5 in BWRVIP-25, the applicant is requested to continue to perform inspections of the rim hold-down bolts. The applicant's response states that inspection techniques are not viable to inspect the integrity of the bolts and requests a deviation from the inspections. However, as stated in its amended response to Action Item 4 in BWRVIP-25, the applicant will submit a plant-specific analysis that either (a) justifies that no inspections are required or (b) determines acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25. This analysis will be submitted to the NRC 2 years before entering the period of extended operation. Therefore, the staff finds the applicant's response acceptable because the applicant will evaluate the need for inspections or the acceptance criteria for continued inspections for the core plate rim hold-down bolts and will submit this response to the NRC. This action will ensure that loss of preload/stress relaxation in the core plate rim hold-down bolts will be managed during the period of extended operation.

For Action Item 4 in BWRVIP-26-A, the applicant is requested to identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue. The applicant's response states that BWRVIP-26-A does not constitute a TLAA because it was not used to make any safety determination or to justify reducing the number of inspections. The staff's evaluation of the applicant's determination that this analysis was not a TLAA is documented in SER Section 4.1. The staff noted that, in Appendix B to the BWRVIP-26-A report, the EPRI BWRVIP included a generic flaw analysis for postulated cracks in BWR top guide grid beam components. The staff noted that this flaw analysis uses a proprietary upper bound fluence value as the basis for establishing the critical stress intensity value for BWR top guide components in the industry. Therefore, it was not evident to the staff why the neutron fluence-dependent irradiation-assisted stress corrosion cracking (IASCC) analysis for the top guide grid beam locations would not need to be identified as a TLAA, especially if the applicant is currently relying on the flaw evaluation in BWRVIP-26-A to justify the conservatisms and validity of the augmented inspection methods and frequencies that will be applied to the top guide grid beam locations at Fermi 2. By letter dated December 23, 2014, the staff issued RAI 4.1-3, requesting that the applicant provide additional clarification on the flaw evaluation methodology for BWR top guide grid beam locations.

The applicant responded to RAI 4.1-3 in a letter dated February 5, 2015. In its response, the applicant stated that Appendix B to BWRVIP-26-A provides a sample flaw evaluation for selected BWR top guide grid beam locations. The applicant also clarified that the sample flaw evaluation in BWRVIP-26-A is not relied on to justify the conservatisms and validity of augmented inspection methods and frequencies for the top guide grid beam locations at Fermi 2. Based on this response, the staff finds that the flaw evaluation in the BWRVIP-26-A report does not need to be identified as a TLAA for the LRA because (a) the analysis is not contained or incorporated by reference in the CLB and (b) the analysis, therefore, does not conform to Criterion 6 in 10 CFR 54.3(a). RAI 4.1-3 and Action Item 4 on BWRVIP-26-A are resolved with respect to this TLAA identification matter, as discussed in SER Section 4.1.

The staff also noted that, in its response to RAI 4.1-3, the applicant indicated that BWRVIP-183 establishes the EPRI BWRVIP's I&E guidelines for the top guide and its components. The applicant stated that it will implement the inspections of the top guide and its components in accordance with the plant procedure for implementing LRA AMP B.1.10, "BWR Vessel Internals," which will be used to implement the inspection guidelines in BWRVIP-183, as applied to the top guide and its components.

The staff noted that GALL Report AMP XI.M9 recommends using BWRVIP-26-A and BWRVIP-183 for the inspection of the top guide and its components. However, the staff noted that, in the NRC's draft final safety evaluation report for BWRVIP-183, dated December 13, 2011, the staff established three conditions/limitations on the use of BWRVIP-183 I&E methodology. However, the EPRI BWRVIP has yet to accept the staff's draft final safety evaluation report for the BWRVIP-183 report. Therefore, as of February 18, 2015, the staff noted that BWRVIP-183 had not been formally endorsed by the NRC. Therefore, if BWRVIP-183 was to be used as the basis for performing augmented inspection and potential flaw evaluations of the top guide, the staff determined that it would need the technical information in the BWRVIP-183 report to be docketed with the Fermi 2 LRA for staff review and approval, as submitted on a plant-specific basis. The staff's full evaluation of the applicant's response to RAI 4.1-3 is evaluated in SER Section 4.1.

By letter dated May 15, 2015, the staff issued RAI B.1.10-3 (followup to RAI 4.1-3), Parts 1, 2, and 3, requesting that the applicant address this issue. Specifically, in RAI B.1.10-3, Part 1, the staff asked the applicant to clarify (with a justification) which BWR Vessel Internals Program element criteria in the BWRVIP-183 report will be used when applying the report to specific I&E activities of the top guide assembly and its components. In RAI B.1.10-3, Part 2, the staff addressed how BWRVIP-183 would be used for the evaluation of flaws if the report was being applied to the evaluation of flaws detected in the top guide assembly. Specifically, the staff asked the applicant to clarify how the flaw evaluation methodology will account for the following factors that may impact the flaw evaluation basis: (a) stress loads for potential flaws detected near component discontinuities, (b) conservative flaw growth assumptions in the methodology, and (c) potential for, and impact of, severed beam locations if flaw growth assumptions in the flaw evaluation methodology are determined to be nonconservative for the top guide beam locations. In RAI B.1.10-3, Part 3, the staff asked the applicant to update the LRA, including LRA Appendix C and any additional enhancements to AMP B.1.10, as appropriate. The staff's evaluation of the response to RAI B.1.10-3 and completion of its review of the applicant's response to Action Item 4 in BWRVIP-26-A will be documented in this SER section.

By letter dated June 9, 2015, the applicant responded to RAI B.1.10-3. The applicant stated that BWRVIP-183 will be used for the inspection and flaw evaluation of the top guide grid beams as part of its BWR Vessel Internals Program. The applicant's response addresses the three conditions/limitations associated with the report to justify its use of the flaw evaluation methodology. For condition (a), as specified in the RAI, the applicant stated that it will demonstrate that the detected flaws will be sufficiently far from geometric discontinuities such that the stress condition in the vicinity of the flaw is consistent with that for a single edge-crack plate and that it will use and justify its application of appropriate K values, which account for effects of geometric discontinuities. For condition (b), the applicant stated that the flaw evaluation in BWRVIP-183 will be used to justify continued operation on a cycle-by-cycle basis.

The applicant stated that it will require NRC approval to justify operation for more than a cycle and that the evaluation will be based on plant-specific operating experience, including crack length measurements of detected top guide grid beam flaws, to benchmark the accuracy of the flaw evaluation methodology. For condition (c), the applicant stated that its severed beam analysis will demonstrate that a completely severed beam will not be expected to interfere with the ability of the CRD system to insert control rods.

The staff finds the response acceptable because, if flaw evaluations are needed for the top guide components, the “monitoring and trending” and “corrective actions” elements of the program will ensure that the flaw evaluations will (1) be based on conservative flaw growth assumptions, (2) consider the impacts of severed top guide beam locations on the assumptions for the analyses, and (3) consider the impacts that geometric discontinuities will have on the stress loads assumed in the analyses if the flaws are located near geometric discontinuities. The staff’s concerns in RAI B.1.10-3 are resolved. Therefore, the staff finds the applicant’s response to Action Item 4 in BWRVIP-26-A acceptable.

For Action Item 4 in BWRVIP-27-A, the applicant is requested to identify and evaluate the projected fatigue cumulative usage factors (CUFs) as a potential TLAA issue. The applicant’s response states that the standby liquid control system/core ΔP (SLC/core ΔP) lines internal to the Fermi 2 RPV are not within the scope of license renewal. The staff’s evaluation of the applicant’s determination that there are no subject fatigue TLAAs for the internal portions of the SLC/core ΔP lines is documented in SER Section 4.1. As part of the staff’s review of LRA Section 4.1 and the applicant’s response to Action Item 4, the staff determined that the applicant had sufficiently demonstrated that the internal portions of the SLC/core ΔP lines would not need to be within the scope of license renewal in accordance with 10 CFR 54.4(a)(1), (a)(2), or (a)(3) and would not need to be the subject of an AMR in accordance with 10 CFR 54.21(a)(1).

Based on its review of the UFSAR and BWRVIP-27-A, the staff determined that the internal portions of the core line would not need to be within the scope of license renewal because they only serve a diagnostic differential pressure reading function and do not serve a license renewal intended function, as defined in 10 CFR 54.4(b). However, the staff noted that the UFSAR indicates that the SLC lines are needed for mitigate the consequences of an anticipated transient without scram event and that the internal portions of the SLC system are needed to promote good mixing of the system’s pentaborate solution into the reactor during an SLC system activation. The staff also noted that the UFSAR indicates that the internal portions of the SLC/core ΔP lines reduce thermal shock to the SLC/core ΔP nozzles during an SLC actuation. Therefore, based on this UFSAR information, the staff concluded that the internal portions of the SLC system may need to be within the scope of license renewal. SER Section 4.1 documents the staff’s evaluation of the applicant’s response to RAI 4.1-4.

By letter dated May 20, 2015, the staff issued RAI 4.1-4a (followup), Parts a, b, and c, to the applicant. SER Section 2.3.3.2 documents the staff’s evaluation of the applicant’s responses to RAI 4.1-4a, Parts a and b, which are associated with the license renewal scoping and screening determination of internal portions of the SLC/core ΔP line. In RAI 4.1-4a (followup), Part c, the staff asked the applicant to identify the applicable aging effects requiring management that apply to the components and to identify (with justification) how these aging effects will be managed during the period of extended operation. Otherwise, the staff asked the applicant to justify why the applicable aging effects do not need to be age-managed if condition-monitoring activities (i.e., inspections) will not be performed on the internal portions of the SLC during the period of extended operation. The staff’s evaluation of the response to RAI 4.1-4a, Part c, and the completion of its review of the applicant's response to Action Item 4 in BWRVIP-26-A report will be documented in this SER section.

By letter dated July 6, 2015, the applicant responded to RAI 4.1-4a. The applicant also provided a supplemental response to RAI 4.1-4a by letter dated August 20, 2015. In response to Parts a and b, the applicant stated that Fermi 2 will conservatively assume that the SLC/core ΔP line internal to the reactor vessel does perform a license renewal intended function per 10 CFR 54.4(a)(3) such that this line will facilitate adequate boron mixing to shut down the core during an anticipated transient without scram event. SER Section 2.3.3.2 documents the staff's full evaluation of RAI 4.1-4a, Parts a and b. In its response to RAI 4.1-4a, Part c, the applicant stated that the SLC/core ΔP line internal to the vessel is stainless steel and exposed to an environment of treated water greater than 140 °F. The applicant stated that this material/environment combination is subject to loss of material and cracking. The applicant will manage loss of material and cracking using the Water Chemistry Control – BWR Program as verified by the One-Time Inspection Program. The applicant also stated that it will manage cracking using the BWR Vessel Internals Program and perform opportunistic inspections of the SLC/core ΔP line internal to the reactor vessel during the period of extended operation. These opportunistic inspections will be included as an enhancement to the BWR Vessel Internals Program. The applicant stated that the inspections will be opportunistic based on plant-specific operating experience that showed no history of degradation, the use of the Water Chemistry Control – BWR Program, the use of the One-Time Inspection Program, and consistency with the recommendations of BWRVIP-27-A. The staff finds the use of the Water Chemistry Control – BWR Program as verified by the One-Time Inspection Program acceptable because (1) the applicant's use of the Water Chemistry Control – BWR Program will ensure that the environment will not be conducive for loss of material and cracking to occur and is consistent with the recommendations in the GALL Report and (2) the One-Time Inspection Program will provide visual and/or equivalent volumetric examination to verify that unacceptable loss of material or cracking is not occurring and may trigger additional actions that ensure that the intended functions of the affected components are maintained throughout the period of extended operation. The staff finds the applicant's use of the opportunistic inspections as part of the BWR Vessel Internals Program acceptable because these inspections will be performed in addition to the aging management activities of the Water Chemistry Control – BWR Program and One-Time Inspection Program to provide additional assurance that cracking will be detected and that appropriate corrective actions will be performed before loss of intended function. The staff's concerns in RAI 4.1-4a are resolved. Therefore, the staff finds the applicant's response to Action Item 4 in BWRVIP-27-A acceptable.

For Action Item 4 in BWRVIP-47-A, the applicant is requested to identify and evaluate the projected CUF as a potential TLAA issue. The applicant's response states that TLAA issues were identified and evaluated for select lower plenum pressure boundary components, which is discussed in LRA Section 4.3.1.4. The staff confirmed that the applicant includes its fatigue analyses for those lower plenum areas that were analyzed in accordance with ASME Code Section III fatigue analysis requirements in LRA Section 4.3.1.4. The staff finds the applicant's response to the action item to be acceptable because it has confirmed that the applicant has included the applicable metal fatigue TLAAs in LRA Section 4.3.1.4. SER Section 4.3.1.4 documents the staff's evaluation of LRA Section 4.3.1.4.

For Action Item 4 in BWRVIP-74-A, the applicant is requested to identify an AMP for the vessel flange leak detection line. The applicant's response states that aging of the vessel flange leak detection line is managed by the Water Chemistry Control – BWR Program, as verified by the One-Time Inspection Program. The acceptance criteria in SRP-LR Section 3.1.2.2.4.1 state that cracking due to SCC and IGSCC could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines and recommend that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC. The staff's evaluation in SER Section 3.1.2.2.4, item 1, provides the staff's basis for accepting that the Water Chemistry Control – BWR Program and One-Time Inspection Program are acceptable to manage cracking due to SSC or IGSSC in the vessel flange leakage detection line. Therefore, based on this review, the staff finds this response acceptable because (1) the Water Chemistry Control – BWR Program will control water chemistry and enable the applicant to effectively manage the occurrence of any cracking or loss of material in the vessel flange leak detection line and (2) the One-Time Inspection Program will adequately determine whether aging degradation is found.

For Action Item 5 in BWRVIP-74-A, the applicant is requested to describe how each plant-specific AMP addresses the 10 elements. The applicant's response states that LRA Appendix B addresses the required 10 elements. The staff verified that all of the AMPs in LRA Appendix B have been defined in accordance with the 10 program elements that are defined in the GALL Report and in SRP-LR Appendix A.1. Therefore, the staff finds the applicant's response to be acceptable because the AMPs in LRA Appendix B adequately address the 10 elements for AMPs recommended in the GALL Report AMP.

For Action Item 6 in BWRVIP-74-A, the applicant is requested to contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry. The applicant's response states that the Water Chemistry Control – BWR Program monitors and controls reactor water chemistry in accordance with BWRVIP-190, which supersedes BWRVIP-29. The staff noted that the BWR water chemistry guidelines in BWRVIP-190 represent the updated version of the EPRI BWRVIP water chemistry guidelines in BWRVIP-29 and implement similar water chemistry control practices as those given in the previous BWRVIP-29 report. The staff verified that the corresponding criteria in BWRVIP-190 implements acceptable water chemistry control practices, including establishment of conservative action levels (i.e., acceptance criteria) for the water chemistry parameters that are defined in the report and guidelines to implement appropriate corrective actions if those action levels are exceeded. Therefore, staff finds the applicant's basis to be acceptable because the staff has verified that the applicant's conformance with the water chemistry guidelines in BWRVIP-190 will provide adequate management of water chemistry at the plant and will be capable of mitigating those aging effects that may be induced by postulated abnormal water chemistry conditions (e.g., loss of material due to general, pitting, or crevice corrosion; SSC; or IGSCC).

For Action Item 7 in BWRVIP-74-A, the applicant is requested to identify its Reactor Vessel Material Surveillance Program. The applicant's response states that Fermi 2 received NRC approval to use the BWRVIP integrated surveillance program (ISP) and applied it to the Reactor Vessel Surveillance Program. The staff verified that the applicant's reactor vessel material surveillance program is given in LRA Section B.1.38, "Reactor Vessel Surveillance." The staff also verified that the applicant's program is an ISP that complies with the requirements for ISPs in Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50. The staff finds this response acceptable because the applicant has included its Reactor Vessel Surveillance Program in the LRA. SER Section 3.0.3.2.19 provides the staff's evaluation of the Reactor Vessel Surveillance Program and the program's basis for generating relevant reactor vessel data to the reactor vessel neutron irradiation embrittlement TLAAs.

For Action Item 8 in BWRVIP-74-A, the applicant is requested to verify that its original fatigue design cycles have been updated to 60 years of operation and to address the effects of environmental fatigue. The applicant's response states that fatigue during the period of extended operation and environmentally assisted fatigue (EAF) have been addressed. The staff verified that the applicant has included the metal fatigue evaluations and EAF evaluation LRA Section 4.3. Therefore, the staff finds the applicant's response to the action item acceptable. SER Section 4.3 documents the staff's evaluations of the metal fatigue analyses and EAF analyses for ASME Code Class 1 and the metal fatigue analyses for non-ASME Code Class 1 components.

For Action Item 9 in BWRVIP-74-A, the applicant is requested to develop a set of pressure-temperature (P-T) curves for the heatup and cooldown operating conditions during the period of extended operation. The applicant's response states that P-T curves were developed, as discussed in LRA Section 4.2.3, and will be updated as required by Appendix G, "Fracture Toughness Requirements," to 10 CFR Part 50. The staff evaluated the applicant's TLAA for managing the aging effects associated with P-T limits, as discussed in LRA Section 4.2.3, and finds the applicant's response to the action item acceptable. SER Section 4.2.3 documents the staff's evaluation of LRA Section 4.2.3.

For Action Item 10 in BWRVIP-74-A, the applicant is requested to demonstrate that the beltline materials meet the Charpy upper-shelf energy (USE) criteria specified in BWRVIP-74-A, Appendix B. The applicant's response states that the USE was evaluated for reactor vessel beltline materials to the end of the period of extended operation (i.e., to 52 effective full-power years (EFPY)) to demonstrate continued compliance with the requirements for USE analyses in Appendix G to 10 CFR Part 50. The applicant also stated that it calculated the applicable USE values for these components in accordance with applicable criteria for USE analyses in RG 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2, dated May 1988, and that the USE analysis is given and discussed in LRA Section 4.2.4. The staff verified that the applicant included its TLAA for USE in LRA Section 4.2.4. Therefore, the staff finds the applicant's response to the action item acceptable. SER Section 4.2.4 documents the staff's evaluation of the TLAA for USE.

For Action Item 11 in BWRVIP-74-A, the applicant can obtain relief from the ISI of the circumferential welds during the license renewal period. The applicant's response states that Fermi 2 has received this relief for the remaining term of the original operating term. An extension of this relief for the period of extended operation will be submitted to the NRC in accordance with 10 CFR 50.55(a), as discussed in LRA Section 4.2.5. The staff verified that the applicant included reactor vessel probability of failure analyses (i.e., TLAAs) for the reactor vessel circumferential welds in LRA Sections 4.2.5 and will use these TLAAs as the basis for submitting a future ISI relief request for the reactor vessel circumferential welds during the period of extended operation. Therefore, the staff finds the applicant's response to the action item acceptable. SER Section 4.2.5 documents the staff's evaluation of this TLAA.

For Action Item 12 in BWRVIP-74-A, the applicant is requested to monitor axial beltline weld embrittlement. The applicant's response indicates that the previous probability of failure analyses for the reactor vessel axial welds is a TLAA for the LRA. The applicant stated that the limiting mean adjusted reference temperature (ART) for these welds has been projected to the expiration of the period of extended operation (i.e., to 52 EFPY) and has been demonstrated to be less than the bounding criteria specified in the BWRVIP report, as discussed in LRA Section 4.2.6. The staff verified that the applicant included the applicable TLAA for the reactor vessel axial welds in LRA Section 4.2.6. Therefore, the staff finds the applicant's response to the action item acceptable. SER Section 4.2.6 documents the staff's evaluation of the probability of failure analysis TLAA for the reactor vessel axial welds.

For Action Item 13 in BWRVIP-74-A, the applicant is requested to either perform neutron fluence calculations using staff-approved methodology or submit plant-specific methodology for staff review. The applicant's response states that its neutron fluence calculations were performed in accordance with RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," dated March 2001, as discussed in LRA Section 4.2.1. The staff verified that the applicant has included its neutron fluence calculations for the reactor vessel beltline components (including those in the extended portion of the beltline) in LRA Section 4.2.1 and that the neutron fluence values for these components have been appropriately extended to the end of the period of extended operation (i.e., to 52 EFPY). Therefore, the staff finds the response acceptable. SER Section 4.2.1 documents the staff's evaluation of the neutron fluence analysis in LRA Section 4.2.1.

For Action Item 14 in BWRVIP-74-A, indications evaluated in accordance with ASME Code Section XI to the end of the original operating term are requested to be re-evaluated for the period of extended operation. The applicant's response states that it analyzed two reactor vessel flaw indications to the end of the period of extended operation, as discussed in LRA Section 4.7.5. The staff verified that the applicant has included the fracture mechanics evaluation TLAA for these flaws in LRA Section 4.7.5. Therefore, the staff finds the applicant's response to the action item acceptable. SER Section 4.7.5 documents the staff's evaluation of fracture mechanics evaluations for these flaws.

For Action Item 4 in BWRVIP-76, Revision 1, the applicant is requested to reference BWRVIP-14-A, BWRVIP-99-A, and BWRVIP-100-A in its evaluation procedures for cracked core shroud welds in the reactor vessel internals AMP and to confirm that it will incorporate any emerging inspection guidelines. The applicant's response states that the BWR Vessel Internals Program references these BWRVIP reports, specifies that the crack growth rate evaluations and fracture toughness values in the reports will be used, and confirms that emerging inspection guidelines will be incorporated into the program. The staff verified that the applicant has included these BWRVIP reports as part of the methodologies that will be applied in accordance with the BWR Vessel Internals Program. Therefore, the staff finds the response acceptable because it evaluated the BWR Vessel Internals Program and confirmed that these items were referenced in the program.

For Action Item 5 in BWRVIP-76, Revision 1, the applicant is requested to incorporate the tie rod cracking operating experience at Hatch 1 into its AMPs. The applicant's response states that Fermi 2 does not have core shroud with tie rod repairs. The staff reviewed the UFSAR and verified that the applicant has yet to implement core shroud modifications, which install tie rod repair assemblies. Therefore, the staff finds the applicant's response acceptable because the staff reviewed the UFSAR and confirmed that the Fermi 2 core shroud design does not include tie rod repair assemblies.

For Action Item 6 in BWRVIP-76, Revision 1, the applicant is requested to identify the aging effects for the core shrouds and core shroud assembly components if a repair design modification has been implemented and to identify the specific AMPs or TLAAs that will be used to manage the effects for the period of extended operation. The LRA states that loss of material; cumulative fatigue damage; and cracking due to SCC, IGSCC, and IASCC have been identified as applicable aging effects for the core shroud. The BWR Vessel Internals Program and the Water Chemistry Control – BWR Program will be used to manage the effects of loss of material due to pitting and crevice corrosion and cracking due to SCC, IGSCC, and IASCC. The Fatigue Monitoring Program will be used to manage cumulative fatigue damage, as discussed in LRA Section 4.3.1.4.

For Action Item 7 in BWRVIP-76, Revision 1, the applicant is requested to identify and manage applicable aging effects for core shroud components or core shroud repair assembly components that are made from materials other than stainless steel or nickel alloy. The applicant's response states that this is not applicable because the Fermi 2 core shroud is fabricated from Type 304L stainless steel and because no repair hardware has been installed. The staff finds this acceptable because the staff reviewed the UFSAR and confirmed the applicant's response.

For Action Item 8 in BWRVIP-76, Revision 1, the applicant is requested to reference BWRVIP-99A and BWRVIP-100-A in its reactor vessel internals AMP. The applicant's response states that these two BWRVIP reports are referenced in the BWR Vessel Internals Program. The staff confirmed the reference in the applicant's program and finds the applicant's response acceptable.

In the applicant's annual update of May 9, 2016, the applicant updated the version of the BWRVIP-76 being used for the core shroud to BWRVIP-76, Revision 1-A, and indicated that the responses to Action Items 4 – 8 are applicable to this version of the BWRVIP report. The staff noted that BWRVIP-76, Revision 1, was approved in an NRC safety evaluation dated December 28, 2015 (ADAMS Accession No. ML15307A468), and that the change in the title to Revision 1-A of the report was strictly an administrative change that is part of EPRI's BWRVIP report review process. The staff noted that BWRVIP-76, Revision 1-A, remains within the scope of the referenced safety evaluation, and that use of Revision 1-A of the report would not alter any of the applicant's response bases for resolving Action Items 4 – 8. Therefore, based on this review, the staff finds the use of BWRVIP-76, Revision 1-A, to be acceptable because: (a) Revision 1-A of the report remains within the scope of the referenced safety evaluation of December 28, 2015, and (b) the applicant's bases for resolving Action Items 4 – 8 in the BWRVIP-76, Revision 1, methodology remain within the scope of Revision 1-A of the report.

Operating Experience. LRA Section B.1.10 summarizes operating experience related to the BWR Vessel Internals Program. The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. The staff noted that the applicant has identified relevant plant-specific operating experience. Flaw indications have been found on the steam dryer support ring and the thermal sleeve to elbow weld on jet pump risers. The other indications were determined not to have operability or safety impacts as confirmed by followup inspections. The applicant identified cracked retainer screw tack welds and restrainer bracket wear on jet pumps. This was repaired by the installation of auxiliary spring wedges and a slip joint clamp. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M9 was evaluated.

UFSAR Supplement. LRA Section A.1.10 provides the UFSAR supplement for the BWR Vessel Internals Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff also noted that the applicant committed to (1) evaluate CASS and X-750 alloy reactor vessel internals components for susceptibility to neutron or thermal embrittlement before the period of extended operation, (2) inspect reactor vessel internals components susceptible to thermal aging, neutron fluence, and cracking before or within 5 years after entering the period of extended operation, and (3) install core plate wedges or complete a plant-specific analysis associated with inspections of the core plate hold-down bolts. Enhancement 3 was amended by letter dated April 27, 2015, as documented in the staff's evaluation of the applicant's response to Action Item 4 in BWRVIP-25 in the section entitled, "Review of License Renewal Applicant Action Items – Appendix C," of this evaluation.

In addition, as a result of its responses to RAIs B.1.10-3 and 4.1-4a, the applicant amended LRA Section A.1.10 to state that the BWR Vessel Internals Program will also be enhanced to state how the three conditions/limitations associated with BWRVIP-183 are addressed to justify its use of the flaw evaluation methodology and that the BWR Vessel Internals Program procedures will be revised to perform opportunistic inspections of the differential pressure and standby liquid control line inside the reactor vessel when the line becomes accessible.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Vessel Internals Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Compressed Air Monitoring

Summary of Technical Information in the Application. LRA Section B.1.11 describes the existing Compressed Air Monitoring Program as consistent, with an exception and enhancements, with GALL Report AMP XI.M24, "Compressed Air Monitoring." The LRA states that the AMP addresses loss of material in piping, compressors, dryers, aftercoolers, and filters in compressed air systems by periodically monitoring air samples for moisture and contaminants and by opportunistically inspecting internal surfaces within compressed air systems. The LRA also states that the inspection frequency, acceptance criteria, and design and operating reviews are conducted in accordance with Fermi 2's response to NRC GL 88-14, "Instrument Air Supply Problems Affecting Safety-Related Equipment," dated August 8, 1988.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M24. The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with an exception and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the exception and enhancements follows.

Exception. LRA Section B.1.11 includes an exception to the "monitoring and trending" program element. In this exception, the applicant stated that the dew point testing and trending is performed quarterly rather than daily as recommended in the GALL Report. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M24 and finds it acceptable because taking quarterly air samples for dew point and contaminants is consistent with the guidance in ASME Code OM-S/G-1998, Part 17, "Performance Testing of Instrument Air System in Light-Water Reactor Power Plant," dated 1998. Additionally, the applicant reviewed operating experience and recent system health reports and did not find any indication that components' intended functions have been compromised. The staff's independent review of operating experience confirmed the applicant's claim.

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 procedures will be revised to periodically sample, test, and monitor moisture and corrosive contaminants to verify that parameters are within acceptable limits in the EDG starting air system to mitigate aging effects, such as loss of material due to corrosion. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M24 and finds it acceptable because, when it is implemented, it will ensure that moisture and contaminants in the EDG starting air system are maintained below acceptable limits.

Enhancement 2. LRA Section B.1.11 includes an enhancement to the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that procedures will be revised to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. Procedures will also be revised to include recommendations from EPRI NP-7079, "Instrument Air System – A Guide for Power Plant Maintenance," dated December 1990; EPRI TR-108147, "Compressed Air System Maintenance Guide," dated March 1998; and ASME Code OM-S/G-1998, Part 17, for air system contaminants, inspection frequency, inspection methods, and acceptance criteria for components subject to an AMR that are exposed to compressed air in the EDG starting air system and control 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 ensure that visual inspections will be conducted and that applicable recommendations for air quality and inspection will be incorporated consistent with the guidance in the GALL Report AMP.

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. The staff also reviewed the exception associated with the "monitoring and trending" 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," "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.1.11 summarizes operating experience related to the Compressed Air Monitoring Program.

In 2007, a walkdown of EDG tubing looked for damaged tubing, tubing routinely taken apart that should be replaced, tubing rubbing against something that could lead to wear, tubing not properly restrained in clamps (at an angle), and operation of a valve that could flex tubing. The walkdown identified bent tubing in the EDG starting air system. A work order was placed, and the tube was repaired.

In August 2011, the applicant issued a corrective action report due to unsatisfactory dew point readings on the west interruptible air supply dryer. The long-term solution is to replace the obsolete air dryer controllers with an equivalent controller.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M24 was evaluated.

UFSAR Supplement. LRA Section A.1.11 provides the UFSAR supplement for the Compressed Air Monitoring Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. 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 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. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Containment Inservice Inspection – IWE

Summary of Technical Information in the Application. LRA Section B.1.12 describes the existing Containment Inservice Inspection – IWE (CII IWE) Program, with enhancements, as consistent with GALL Report AMP XI.S1, “ASME Section XI, Subsection IWE.” Fermi 2 has a General Electric Mark I pressure suppression steel containment, which consists of a drywell, a torus, and a vent system connecting the drywell and torus. The current interval code of record for examination of the containment is “in accordance with ASME Code Section XI, Subsection IWE, 2001 Edition with the 2003 Addenda, as mandated and modified by 10 CFR 50.55a.” The LRA states that the AMP is a condition-monitoring program and manages the effects of aging on the free-standing steel containment vessel and its integral attachments, containment hatches, airlocks, moisture barriers, and pressure-retaining bolting. The LRA also states that the AMP proposes to manage these aging effects through periodic visual examinations (general visual, VT-1, and VT-3) to assess the general condition of the containment and to detect evidence of degradation that may affect structural integrity or leak tightness. The LRA further states that visual inspections monitor loss of material of the steel containment vessel surface areas, including welds and base metal and containment vessel integral attachments, metal shell, personnel and equipment access hatches, and pressure-retaining bolting. The program addresses the aging management activities of LR-ISG-2006-01, “Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor (BWR) Mark I Steel Containments Drywell Shell,” dated November 16, 2006, for inaccessible areas of BWR Mark I drywell shell.

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.S1.

For the “preventive action,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “corrective actions” 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 of GALL Report AMP XI.S1 recommend preventive actions in accordance with the Research Council for Structural Connections (RCSC) report entitled, “Specification for Structural Joints Using ASTM A325 or A490 Bolts,” dated June 30, 2004 (hereinafter referred to as the RCSC report), for structural bolting consisting of ASTM A325, ASTM F1852, and ASTM A490 bolts. The staff noted during its audit that the corresponding element, with enhancements, of the LRA AMP basis document addresses ASTM A325 and ASTM A490 bolting but made no mention of ASTM F1852 bolting. The staff was not clear if the above mentioned program element of the LRA AMP is consistent with the recommendations in the GALL Report AMP because there was no mention of ASTM F1852 bolting. Therefore, by letter dated November 25, 2014, the staff issued a common RAI B.1.42-1 across LRA AMPs B.1.42, B.1.22, and B.1.12 requesting that the applicant clarify whether ASTM F1852 structural bolting was used in Fermi 2 structures and, if so, explain how the effects of aging will be adequately managed for this bolting type.

In its response to RAI B.1.42-1 dated December 26, 2014, the applicant confirmed that the Fermi 2 plant does not use ASTM F1852 structural bolting based on a review of applicable site documents, material management and inventory systems, and consulting cognizant plant personnel.

The staff finds the applicant’s response acceptable because the applicant confirmed that ASTM F1852 structural bolting was not used at Fermi 2. The staff’s concern described in RAI B.1.42-1 is resolved.

The “detection of aging effects” program element in GALL Report AMP XI.S1 recommends that the program be augmented to require surface examination, in addition to visual examination, to detect cracking in (a) stainless steel and dissimilar metal welds of penetration sleeves, penetration bellows, and vent line bellows and (b) steel components that are subject to cyclic loading but have no CLB fatigue analysis. This program element also states that, where feasible, appropriate Appendix J to 10 CFR Part 50 tests may be performed in lieu of surface examination. However, during its audit, the staff found that the “detection of aging effects” program element of the applicant’s Containment Inservice Inspection – IWE Program states that stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no CLB fatigue analysis are monitored for cracking. It also states that the Containment Leak Rate Program (Appendix J to 10 CFR Part 50) tests may be performed in lieu of surface examination. It was not clear that the method for detecting cracking in these components is consistent with that described in GALL Report AMP XI.S1. Additionally, for components that may be subject to Appendix J tests in lieu of surface examination, the program did not mention the type of Appendix J test that would be performed for the specific components to allow the staff to evaluate the appropriateness of the test to detect cracking. By letter dated December 16, 2014, the staff issued RAI B.1.12-1 requesting that the applicant state whether supplemental surface examinations will be performed as recommended in the GALL Report on the following specified components: (a) stainless steel and dissimilar metal welds of penetration sleeves, penetration bellows, and vent line bellows and (b) steel components that are subject to cyclic loading but have no CLB fatigue analysis. If such examinations will be performed, the applicant should indicate what standard will be used to perform surface examination of the stainless steel and dissimilar metal welds. The staff also requested that, if Appendix J tests are used in lieu of surface examinations for certain components, the applicant indicate the type of Appendix J test that will be used and justify its appropriateness.

In its response to RAI B.1.12-1 dated January 15, 2015, the applicant stated that the penetration sleeves at Fermi 2 are of carbon steel material but some include dissimilar metal welds. The penetration bellows and the dissimilar metal welds of the penetration sleeves are inaccessible, and it is not possible to perform a surface examination. The applicant also explained that due to the industrial safety hazards (i.e., steep angle pipe configuration, high radiation area, contamination area, and confined space), it is not feasible to perform a supplemental surface examination on the torus vent line bellows. Therefore, the supplemental surface examination discussed in GALL Report AMP XI.S1 will not be performed for the components with stainless steel or dissimilar metal welds. The applicant further stated that, as allowed by recommendations in the “detection of aging effects” program element of GALL Report AMP XI.S1, it plans to credit the conduct of test under Appendix J to 10 CFR Part 50 (GALL Report AMP XI.S4) in lieu of surface examination to supplement Subsection IWE general visual examinations for detecting cracking in stainless steel or dissimilar metal welds of containment pressure-retaining penetration sleeves and bellows (penetration and vent line) components. The applicant further explained that the Appendix J tests that are performed on the penetration sleeves, penetration bellows, and torus vent line bellows are Type B tests (for bellows) and Type A integrated leak rate tests (for bellows and sleeves) in accordance with the Fermi 2 Containment Leak Rate Program (LRA Section B.1.13) and are consistent with GALL Report AMP XI.S4. The applicant also stated that with the low leak rate acceptance criterion for the bellows at Fermi 2 of less than or equal to 1 scfh, the Type B testing is able to detect extremely small leaks due to cracking in the bellows before loss of intended function. The applicant also clarified that the evaluation of its applicable bellows (i.e., torus vent line bellows) against the operating experience described in NRC IN 92-20, "Inadequate Local Leak Rate Testing," dated March 3, 1992, concluded that the bellows construction is that which allows a Type B test to be performed. The applicant also stated that it did not identify any containment steel components at Fermi 2, including the sleeve and bellows components with stainless steel or dissimilar metal welds described above, that are subject to cyclic loading but have no CLB fatigue analysis. The applicant concluded that its use of Appendix J tests for stainless steel or dissimilar metal welds of penetration sleeves and bellows, in lieu of supplemental surface examination, is consistent with the "detection of aging effects" program element of GALL Report AMP XI.S1. The applicant revised LRA Sections A.1.12 and B.1.12 to clarify that the alternative of Appendix J tests is being used for the stainless steel and dissimilar metal welds of the penetration sleeves, penetration bellows, and torus vent line bellows, as allowed by GALL Report AMP XI.S1. The applicant also included wording that the program specifies (Subsection IWE) augmented inspections as required.

The response to RAI B.1.12-1 clarified that supplemental surface examination will not be performed because the penetration sleeves (carbon steel) with dissimilar metal welds and the penetration bellows (stainless steel) are inaccessible at Fermi 2, and because of the industrial safety hazards, it is also not feasible to perform a supplemental surface examination on the torus vent line bellows (stainless steel). Alternatively, the applicant will perform applicable and feasible Appendix J tests (Type A and Type B tests for penetration and vent line bellows and Type A tests for dissimilar metal welds of penetration sleeves) in lieu of surface examination, which is consistent with the recommendation of GALL Report AMP XI.S1. The Type B tests will have a low administrative leak rate acceptance criteria able to detect small leaks through cracks, and for the case in which the Type B test is not feasible (dissimilar metal welds of penetration sleeves), the Type A test would reflect leakage from cracking; therefore, the use of Type A and Type B leak tests is an appropriate supplemental means of detecting cracking. The applicant also clarified that there are no containment pressure-retaining steel components at Fermi 2 that are subject to cyclic loading but have no CLB fatigue analysis.

The staff finds the applicant's response acceptable because the response confirms that the applicant will use appropriate and feasible Type A and Type B leak rate tests under Appendix J to 10 CFR Part 50 in lieu of supplemental surface examination to detect cracking in dissimilar metal welds of penetration sleeves and in stainless steel penetration bellows and torus vent line bellows, which is consistent with the recommendations of GALL Report AMP XI.S1. The staff's concern described in RAI B.1.12-1 is resolved.

The "preventive action" program element in GALL Report AMP XI.S1 recommends that the program be augmented to include preventive actions that ensure that moisture levels associated with an accelerated corrosion rate do not exist in the exterior portion of the BWR Mark I steel containment drywell shell. The actions consist of ensuring that the sand pocket area drains and/or the refueling seal drains are clear. The "parameters monitored or inspected" program element of GALL Report AMP XI.S1 recommends that applicants with BWR Mark I steel containments should monitor sand pocket area drains and/or the refueling seal drains for water leakage and should ensure that the drain lines are clear to prevent moisture levels associated with accelerated corrosion rates in the exterior portion of the drywell shell. However, during its audit, the staff found that the applicant's enhancements to the "preventive action," "parameters monitored or inspected," and "detection of aging effects" program elements (associated with Commitment Nos. 9a, 9d, and 9e) do not clearly demonstrate consistency with the GALL Report, as claimed in LRA Section B.1.12. The staff identified the need for additional information to determine that the proposed enhancements are consistent with the recommendation for BWR Mark I steel containments in the "preventive actions" and "parameters monitored or inspected" program elements. By letter dated December 16, 2014, the staff issued RAI B.1.12-2 requesting that the applicant clarify whether the intent of Commitment Nos. 9a, 9d, and 9e is to revise plant procedures before the period of extended operation or to revise plant procedures and perform inspection of drain lines before the period of extended operation. The staff also requested that the applicant describe the objective(s) for the program enhancements as listed in Commitment Nos. 9a and 9d and to provide the frequency of inspection associated with Commitment Nos. 9a, 9d, and 9e. Further, the staff requested that the applicant clarify whether the LRA AMP B.1.12 includes actions to ensure that the refueling seal drains are clear to prevent moisture levels associated with accelerated corrosion rates in the exterior portion of the drywell shell.

In its response dated January 15, 2015, the applicant stated that the objective for the sand cushion drain lines inspections in Commitment Nos. 9a and 9d is to determine the internal condition (e.g., moisture, sand, and blockage) and to confirm that the drains are not blocked. The applicant also stated that the inspections will be performed one time before the period of extended operation and once every 10 years during the period of extended operation. The applicant explained that the sand cushion drain lines have been inspected for blockage twice so far, with the most recent inspection being in 2014, after approximately 29 years of plant operation. The inspections revealed that the drain lines were not blocked or obstructed; therefore, based on the Fermi 2 operating experience, an additional inspection before the period of extended operation and once every 10 years during the period of extended operation are considered appropriate to ensure that the sand cushion drain lines are clear.

The applicant further clarified in its response that its Containment Inservice Inspection – IWE Program does include actions to visually check the refueling seal drain line and the sand cushion area drain lines for water leakage every RFO to prevent accumulation of moisture on the exterior portion of the drywell shell. The applicant explained in detail that it is not practical to inspect the refueling seal drain line to ensure it remains clear because the opening to the drain line itself is inaccessible because it is sealed off by the drywell seals bellows assembly and associated plates, which constitute a welded seal boundary. The applicant further explained that, based on the stainless steel material, fatigue design, and water chemistry management, leakage through the drywell seal bellows is unlikely. However, the sand cushion area drain lines have been inspected and will be inspected again before and during the period of extended operation to ensure they are not blocked. The applicant further stated that, because GALL Report AMP XI.S1 recommends that the sand cushion area drains **and/or** (emphasis added) refueling sealing drains are monitored for water leakage, ensuring that the drains are clear, its commitment to monitor only the sand cushion drain lines for blockage is consistent with the GALL Report recommendations. The applicant also revised and consolidated license renewal Commitment Nos. 9a, 9d, and 9e into one commitment designated Commitment No. 9a to clarify the timing and frequency of the sand cushion drain line internal inspections. This revised Commitment No. 9a to be implemented before the period of extended operation and that is applicable to "preventive action," "parameters monitored or inspection," and "detection of aging effects" program elements states, "Revise plant procedures to require inspection of the sand cushion drain lines (e.g., for moisture, sand, [and] blockage) and [to] ensure there is no evidence of blockage at least once prior to the period of extended operation and once every 10 years during the period of extended operation." The applicant revised LRA Sections A.1.12, A.4, and B.1.12 to delete Commitment Nos. 9d and 9e and to reflect the revised Commitment No. 9a.

The applicant’s response clarified that the objective of Commitment Nos. 9a, 9d, and 9e (revised and consolidated in the response as Commitment No. 9a) is to inspect the sand cushion drain lines to determine its internal condition to confirm that they are clear (i.e., not blocked). The revised Commitment No. 9a clearly states that the sand cushion drain lines will be inspected to determine the internal condition and to ensure they are not blocked once before the period of extended operation and once every 10 years during the period of extended operation. The staff finds the timing and frequency of the inspections reasonable to ensure that the sand cushion drain lines are clear during the period of extended operation. The response further clarified and justified that, even though the refueling seal drains cannot be inspected for blockage, the commitment to inspect only the sand cushion drain lines for internal condition (e.g., moisture, sand, and blockage) and blockage is consistent with the GALL Report recommendations to prevent moisture levels associated with accelerated corrosion rates in the exterior portion of the drywell shell.

The staff finds the applicant’s response acceptable because the revised and consolidated enhancement (Commitment No. 9a) in the response clearly states the objective, timing, and frequency of the applicant’s commitment to inspect the sand cushion drain lines to ensure they are clear, which demonstrates consistency with the GALL Report recommendations to prevent moisture levels associated with accelerated corrosion rates in the exterior portion of the drywell shell. The staff’s concern described in RAI B.1.12-2 is resolved.

The “preventive action” program element in GALL Report AMP XI.S1 recommends that the program be augmented to include preventive actions that ensure that moisture levels associated with an accelerated corrosion rate do not exist in the exterior portion of the BWR Mark I steel containment drywell shell. The “parameters monitored or inspected” program element of GALL Report AMP XI.S1 recommends that applicants with BWR Mark I steel containments should monitor sand pocket area drains and/or the refueling seal drains for water leakage and should ensure that the drain lines are clear to prevent moisture levels associated with accelerated corrosion rates in the exterior portion of the drywell shell. However, during its audit, the staff found contradictory statements between the “preventive actions” and “parameters monitored or inspected” program elements of the LRA AMP. The “preventive actions” program element states the following:

> During refueling the refueling bellows drain empties into a manifold which is equipped with a sight glass. This sight glass is monitored when the refueling pool is flooded to detect potential leakage of water into the space around the drywell shell. The sand pocket drains are also being monitored for signs of moisture. Fermi 2 plans to re-inspect the drain lines to verify their condition prior to the period of extended operation to confirm that these preventative actions are not warranted (emphasis added). The program will be enhanced to require inspection of the sand pocket drain lines prior to the period of extended operation.

The “parameters monitored or inspected” program element states that “Fermi 2 performs routine surveillances of the drains to record the observed condition of the drain lines for any leakage. Fermi 2 will inspect the sand pocket drain lines to verify their condition prior to the period of extended operation to confirm that the sand pocket drains are clear.” As documented in the Audit Report, the staff noted that Fermi 2 Surveillance Procedure 24.000.03 required inspection of the reactor-drywell seal bellows and the four sand cushion drain lines for leakage every RFO, as part of regulatory commitments made in response to NRC GL 87-05, “Request for Additional Information Assessment of Licensee Measures to Mitigate and/or Identify Potential Degradation of Mark I Drywells." However, it was not clear if the periodic monitoring of the sand cushion drain lines and refueling seal bellows for water leakage every RFO will continue consistent with the recommendations in the "parameters monitored or inspected" program element of GALL Report AMP XI.S1. By letter dated December 16, 2014, the staff issued RAI B.1.12-3 requesting that the applicant confirm if the refueling seal bellows and the sand cushion drain lines of the Fermi 2 Mark I steel containment will continue to be monitored periodically every RFO for water leakage or signs of moisture during the period of extended operation. The staff also requested that the applicant clarify the apparently contradictory statement that "Fermi 2 plans to re-inspect the drain lines to verify their condition prior to the period of extended operation to confirm that these preventive actions are not warranted."

In its response to RAI B.1.12-3 dated January 15, 2015, the applicant stated that it plans to continue monitoring of the drywell seal bellows and sand cushion drain lines every RFO for water leakage or signs of moisture through the period of extended operation. The applicant clarified that the statement "to confirm that these preventative actions are not warranted" was intended to indicate that periodic confirmation that the sand cushion drain lines were clear is not necessary during the period of extended operation. The applicant further explained that, as discussed in the response to RAI B.1.12-2, it revised Commitment No. 9a to specify inspection of the drain lines to verify their condition before the period of extended operation and once every 10 years during the period of extended operation.

The staff finds the applicant's response acceptable because the applicant (a) confirmed that the reactor drywell seal bellows and the four sand cushion drain lines will continue to be monitored for water leakage every RFO during the period of extended operation, and (b) clarified that, based on its revised Commitment No. 9a in response to RAI B.1.12-2, the sand cushion drain lines will be inspected to ensure that they are clear once before the period of extended operation and once every 10 years during the period of extended operation. These actions are consistent with the recommendations of the "parameters monitored or inspected" program element of GALL Report AMP XI.S1 with regard to BWR Mark I steel containment. The staff's concern described in RAI B.1.12-3 is resolved.

The "monitoring and trending" program element in GALL Report AMP XI.S1 recommends that, for plants with a BWR Mark I containment, license renewal applicants develop a corrosion rate that can be inferred from past ultrasonic thickness measurements or establish a corrosion rate using representative alternate means to provide a technical basis based on the developed or established corrosion rate that the drywell will have sufficient thickness to perform its intended function through the period of extended operation. However, during its audit, the staff found that the applicant's enhancement (Commitment No. 9f) to the "monitoring and trending" program element of the Containment Inservice Inspection – IWE Program states, "Revise plant procedures to determine drywell shell thickness in the sand pocket areas before the period of extended operation. From the results, develop a corrosion rate to demonstrate that the drywell shell will have sufficient thickness to perform its intended function through the period of extended operation." The staff also noted that, for justified reasons summarized in LRA Section B.1.12, ultrasonic thickness measurements of the drywell shell sand pocket areas were not performed at Fermi 2 in response to NRC GL 87-05. It was not clear to the staff that this enhancement would make the program consistent with the GALL Report because the proposed enhancement (Commitment No. 9f) does not indicate the minimum number of sets and interval at which UT measurements will be performed and because it does not provide the technical basis of how an appropriate corrosion rate will be developed if only one set of UT measurements is intended. By letter dated December 16, 2014, the staff issued RAI B.1.12-4 requesting that the applicant state the minimum number of sets of UT measurements and the interval at which they will be performed to determine the corrosion rate of the drywell shell sand pocket area and provide the technical basis that the drywell shell will have sufficient thickness to perform its intended function through the period of extended operation. If only one set of UT measurements will be performed, the staff requested that the applicant provide the technical basis of how an appropriate or conservatively biased corrosion rate will be developed based on one set of UT measurements.

In its response to RAI B.1.12-4 dated January 15, 2015, the applicant stated the following:

> One set of UT measurements was taken in spring of 2014 (RF16) on the drywell shell sand cushion area. The measurements were taken from [azimuth] 300 degrees progressing clockwise every 12 inches and ending at [azimuth] 120 degrees. One reading was taken at the moisture barrier and another reading was taken approximately 6 inches above the moisture barrier. Out of the 150 readings taken, the lowest reading was 1.557 inches and the highest reading was 1.690 inches. All measurements were above the nominal design value of 1.5 inches, with no apparent material loss after almost 30 years of operation, so there is reasonable assurance that the drywell shell will have sufficient thickness to perform its intended function throughout the period of extended operation (PEO). A second set of UT measurements will be taken prior to the PEO [period of extended operation] to determine a corrosion rate from the two sets. UT measurements will be re-performed once each interval (i.e. ten [10] years) during PEO [period of extended operation].

The applicant also revised the program enhancement (Commitment No. 9f) in LRA Sections A.1.12, A.4, and B.1.12 to reflect the schedule and interval, indicated in the response above, at which drywell shell thickness will be determined to develop the corrosion rate.

The staff notes that the set of 150 UT measurements made of the drywell shell sand pocket area in spring 2014 demonstrate that all the measured thickness values are above the nominal design thickness of 1.5 inches, indicating no apparent significant corrosion degradation after 30 years of operation. The applicant clarified that two sets of UT measurements of the sand cushion area taken before the period of extended operation, approximately 10 years apart, will be used to determine the corrosion rate of the drywell shell. The corrosion rate will be further confirmed by performing UT measurements at a 10-year interval during the period of extended operation. The staff finds the applicant's response acceptable because (a) the applicant's commitment to determine the corrosion rate of the drywell shell based on two sets of UT measurements of the sand cushion before the period of extended operation, followed by confirmatory UT measurements on a10-year interval during the period of extended operation, will provide an adequate technical basis to demonstrate that the drywell shell will have sufficient thickness to perform its intended function through the period of extended operation, (b) the applicant revised the commitment to reflect the schedule and interval of UT measurements before and during the period of extended operation, and (c) the response clarified consistency of the program element with the GALL Report. The staff's concern described in RAI B.1.12-4 is resolved.

The "corrective actions" program element in GALL Report AMP XI.S1 recommends that, if moisture has been detected or suspected in the inaccessible area on the exterior of the Mark I containment drywell shell or if the source of moisture cannot be determined subsequent to a root cause analysis, then the following applies:

- Include in the scope of license renewal any components that are identified as a source of moisture, if applicable, such as the refueling seal or cracks in the stainless liners of the refueling cavity pools walls, and perform an AMR.
- Identify surfaces requiring examination by implementing augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, “Examination Category E-C.”
- Use examination methods that are in accordance with Subsection IWE-2500.
- Demonstrate, through use of augmented inspections performed in accordance with Subsection IWE, that corrosion is not occurring or that corrosion is progressing so slowly that the age-related degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.

However, during its audit, the staff found that the applicant’s Containment Inservice Inspection – IWE Program did not address the above action of GALL Report AMP XI.S1, which recommends including any components that are identified as a source of moisture, if applicable, within the scope of license renewal and performing an AMR. It was not clear that the “corrective actions” program element of the Containment Inservice Inspection – IWE Program is consistent with the recommendations in GALL Report AMP XI.S1, as claimed in the LRA. By letter dated December 16, 2014, the staff issued RAI B.1.12-5 requesting that the applicant clarify whether applicable components that are sources of moisture to inaccessible areas of the Mark I containment drywell shell exterior have been identified and subjected to an AMR and, if so, that it list the components that have been identified as potential sources of moisture to inaccessible areas of the drywell exterior.

In its response dated January 15, 2015, the applicant stated that the components that are potential sources of moisture to the inaccessible area of the drywell exterior are the reactor cavity liner and the refueling bellows assembly. The applicant stated that these components are subject to an AMR as indicated in LRA Table 2.4-1 and that the AMR results are provided in LRA Table 3.5.2-1. The applicant further stated that, as noted in LRA Table 3.5.2-1, loss of material for the stainless steel reactor cavity liner is managed by the Water Chemistry Control – BWR AMP, and loss of material for the refueling bellows assembly is managed by the Water Chemistry Control-BWR and Structures Monitoring AMPs.

The staff reviewed LRA Table 2.4-1 and verified that the reactor cavity liner and the refueling bellows assembly were included as components subject to an AMR. The staff also reviewed LRA Table 3.5.2-1 and verified that applicable aging effects (i.e., loss of material and cracking) that could result in leakage from these components were being managed using appropriate AMPs and/or TLAAs. The staff finds the applicant’s response acceptable because the applicant confirmed that it addressed recommended Item (a) in the “corrective actions” program element of GALL Report AMP XI.S1 by identifying the components that are potential sources of moisture to inaccessible areas of the drywell exterior, provided references to the LRA tables that document these components that were subjected to AMR and the AMR results, and provided a response that clarified consistency of the program element with the GALL Report. The staff’s concern described in RAI B.1.12-5 is resolved.

The staff also reviewed the portions of the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “corrective actions” program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.12 includes an enhancement to the "preventive actions" program element. In this enhancement (Commitment 9b), the applicant stated that, before the period of extended operation, plant procedures will be revised to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, EPRI NP-5067, "Good Bolting Practices – A Reference Manual for Nuclear Power Plant Maintenance Personnel, Volume 1: Large Bolt Manual, 1987; Volume 2: Small Bolts and Threaded Fasteners, 1990," and EPRI TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and use of lubricants and sealants for high strength bolting. 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 ensure integrity of structural bolting, which is consistent with the recommendations of GALL Report AMP XI.S1.

Enhancement 2. LRA Section B.1.12, as clarified by letter dated December 26, 2014, in response to RAI B.1.42-1, includes an enhancement to the "preventive actions" program element. In this enhancement (Commitment No. 9c), the applicant stated that, before the period of extended operation, plant procedures will be revised to include the preventive actions for ASTM A325 and ASTM A490 bolting from Section 2 of the Research Council for Structural Connection publication entitled, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S1 and finds it acceptable because, when it is implemented, it will provide guidance for "preventive actions" to ensure integrity of ASTM A325 and/or ASTM A490 structural bolting, which is consistent with the recommendations of GALL Report AMP XI.S1.

Enhancement 3. LRA Section B.1.12, as amended by letter dated January 15, 2015 in response to RAI B.1.12-2, includes an enhancement applicable to the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements. In this enhancement (Commitment No. 9a), the applicant committed to revise plant procedures, before the period of extended operation, to require inspection of the sand cushion drain lines (e.g., for moisture, sand, and blockage) and to ensure there is no evidence of blockage at least once before the period of extended operation and once every 10 years during the period of extended operation. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S1 and finds it acceptable because, when it is implemented, it will ensure that moisture levels associated with accelerated corrosion rates do not exist in the exterior portion of the Fermi 2 Mark I steel containment drywell shell by taking preventive actions that are consistent with the recommendations of GALL Report AMP XI.S1.

Enhancement 4. LRA Section B.1.12, as amended by letter dated January 15, 2015 in response to RAI B.1.12-4, includes an enhancement to the "monitoring and trending" program element. In this enhancement (Commitment No. 9f), the applicant committed to revise plant procedures to determine the drywell shell thickness in the sand cushion areas before the period of extended operation and once in each 10-year interval during the period of extended operation. From the results (including prior results), the applicant committed to develop a corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation. 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 a technical basis, consistent with the GALL Report recommendations for Mark I steel containment, to develop a corrosion rate and to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation.

Enhancement 5. LRA Section B.1.12, as clarified by letter dated January 15, 2015 in response to RAI B.1.12-5, includes an enhancement to the "corrective actions" program element. In this enhancement (Commitment No. 9g), the applicant committed to revise plant procedures, before the period of extended operation, to require corrective actions if moisture is detected or suspected in the inaccessible area on the exterior of the drywell shell. The three corrective actions include the following:

(1) identifying surfaces that require augmented inspections in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, "Examination Category E-C"

(2) using examination methods that are in accordance with Subsection IWE-2500

(3) demonstrating through augmented inspections, performed in accordance with Subsection IWE, that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S1 and finds it acceptable because, when it is implemented, it will ensure appropriate corrective actions, consistent with the GALL Report recommendations, if moisture is detected or suspected in the inaccessible area on the exterior of the Fermi 2 Mark I containment drywell shell or if the source of moisture cannot be determined.

Based on its audit and review of the applicant's responses to RAIs B.1.42-1 and B.1.12-1 through B.1.12-5, 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.S1. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "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.1.12 summarizes operating experience related to the Containment Inservice Inspection – IWE Program. The applicant described examples of plant-specific operating experience and evaluation of applicable industry operating experience to provide objective evidence that the Containment Inservice Inspection – IWE Program will be effective in ensuring that intended functions will be maintained during the period of extended operation. Some of these examples are described below.

Drywell. Only one corrosion pit has been detected in the drywell shell. This pit, which measured 0.02 inch by 0.04 inch by 0.093 inch deep, was detected during ISI examinations in 2000. The corrosion was attributed to a screw and uncoated washer that were in contact with an uncoated portion of the drywell shell in a beam seat area. The screw and washer were removed. The drywell shell in the area of the pit was coated in 2003.

Sand Pocket Region. Fermi 2 first noted drainage from the sand pocket drain lines in 1989. This leakage was a minimal one-to-two drops per minute. Analysis of leakage for tritium and gamma emitters indicated that the source was not reactor cavity water. During startup from the RFO in September 1992, leakage was still minimal at approximately one drop per minute, and during a short period after startup, the leakage was recorded as zero. Leakage has been periodically monitored and has remained at zero since 1993.

During a RFO in 1994, Fermi 2 planned to remove the sand from around the sand pocket drains and expose a small portion of the liner to perform a visual inspection at the four locations. The sand was removed from the sand pocket drain lines, but personnel were unable to inspect the drywell shell due to access limitations of the video probe. The sand in the sand pocket zone was found highly compacted. The LRA states that Fermi 2 evaluated NRC IN-2011-15, "Steel Containment Degradation and Associated Aging Management Issues," dated August 11, 2011. Although the evaluation determined that no accelerated actions were warranted, the applicant initiated planning for a borescope inspection of the sand pocket drains and UT examinations of the shell in the vicinity of the sand cushion.

In 2013, all four sand cushion drain lines were internally inspected with a boroscope. There were indications of sand in the bottom of three of the pipes and soft sand at the ends of the pipe. No water was present, and the sand would have allowed a drain path through the pipe. In three cases, the boroscope reached the 90-degree elbow at the sand cushion; in the other case, the boroscope could not reach the final foot of the pipe before the elbow because of the presence of sand. There were signs of corrosion in three of the pipes, showing that moisture had been present in the past. UT measurements taken in 2014 of the drywell shell in the sand cushion area showed thicknesses above the design value, indicating no or minimal apparent loss of material after almost 30 years of operation.

The LRA also summarized the technical basis provided to the NRC for not performing UT examination of the drywell shell plates adjacent to the sand pocket region in its response to NRC GL 87-05, which addressed the potential for corrosion of BWR Mark I steel drywells in the sand pocket region.

Torus. The LRA states that the torus is inspected in alternate RFOs. An inspection was performed in 2012 when 100 percent of the torus wetted and vapor space was inspected by qualified NDE inspectors. No pitting of the torus primary containment boundary was identified. One 0.25 inch-diameter pit has been identified in the torus wetted area during the history of the plant. This 0.0285-inch-deep corrosion pit was identified under a coating blister in 2001. The depth of the pit left the remaining shell thickness well within design tolerances. The coating was repaired.

Coating condition continues to be monitored during inspections. During 2012, broken blisters, mechanical damage, and pinpoint rust areas were identified and repaired in the wetted areas of the torus. In the vapor region, all flaking paint was removed from the torus ring header, torus vacuum breaker valves, nitrogen supply lines, monorail rail, and torus walkway and handrail. Flaking or cracked coating was removed and protective coating was reapplied to the torus shell.

The applicant evaluated NRC IN-2006-01, "Torus Cracking in a BWR Mark I Containment," dated January 12, 2006, which described a through-wall crack and its probable cause in the torus of a BWR Mark I containment. The applicant determined that the Fermi 2 HPCI design has a turbine exhaust pipe sparger that precludes this condition. The LRA states that the Containment Inservice Inspection – IWE Program considers the industry operating experience provided in NRC IN 86-99, "Degradation of Steel Containments," dated December 8, 1986; IN 88-82, "Torus Shells with Corrosion and Degraded Coatings in BWR Containments," dated October 14, 1988; IN 89-79, "Degraded Coatings and Corrosion of Steel Containment Vessels," dated December 1, 1989; IN 2004-09, "Corrosion of Steel Containment and Containment Liner," dated April 27, 2004; and NUREG-1522, "Assessment of Inservice Conditions of Safety-Related Nuclear Plant Structures," dated June 1995, as discussed in the "operating experience" element of the GALL Report AMP. In addition, the program evaluates plant-specific and industry operating experience, and relevant information and lessons learned are incorporated into the program.

As documented in the Audit Report, the staff noted during the audit that Fermi 2 has a proactive inspection program of the interior wetted surfaces of submerged areas of the torus and the vent header. The interior of the torus is inspected and repaired on an every other RFO basis. During these examinations, the submerged areas of the torus shell are cleaned from water line to water line to remove sludge and other foreign material following which coating inspectors inspect the entire area by VT-3 visual. All areas of broken blisters and mechanical damage exhibiting corrosion on the pressure boundary immersion area are repaired. Additionally, Fermi 2 monitors the blister condition on specific immersed areas of the torus, which are chosen based on their relatively high number of indications. During each inspection, the size, population density and condition of the blisters are monitored and trended to identify and evaluate adverse trends.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S1 was evaluated.

<u>UFSAR Supplement</u>. LRA Section A.1.12 provides the UFSAR supplement for the Containment Inservice Inspection – IWE Program. The staff reviewed this UFSAR supplement description of the program, as amended by letter dated January 15, 2015, 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. 9) to implement the enhancements to the program before the period of extended operation (i.e., before September 20, 2024, or the end of the last outage before March 20, 2025, whichever is later). The staff finds that the information in the UFSAR supplement, as amended by letter dated January 15, 2015, is an adequate summary description of the program.

<u>Conclusion</u>. On the basis of its audit; review of the applicant's responses to RAIs by letters dated December 26, 2014, and January 15, 2015; and review of the applicant's Containment Inservice Inspection – IWE Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the

UFSAR supplement for this AMP, as amended by letter dated January 15, 2015, 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 Diesel Fuel Monitoring

Summary of Technical Information in the Application. As amended by letter dated May 19, 2015, LRA Section B.1.14 describes the existing Diesel Fuel Monitoring Program as consistent, with enhancements, with GALL Report AMP XI.M30, "Fuel Oil Chemistry." The LRA states that the Diesel Fuel Monitoring Program manages loss of material in piping, tanks, and other components exposed to an environment of diesel fuel by periodically testing the quality of the fuel oil. The program monitors water, sediments, total particulate, biodiesel concentration, and levels of microbiological activity. Additionally, the program periodically samples, drains, cleans, and internally inspects tanks for signs of moisture, contaminants and corrosion.

A one-time inspection activity will be performed to verify the effectiveness of the Diesel Fuel 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.M30. The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.14 includes an enhancement to the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements. In this enhancement, the applicant stated that it will revise procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank quarterly. In addition, the applicant will revise the procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively. 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 AMP.

Enhancement 2. LRA Section B.1.14 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise procedures to include a 10-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions: "If visual inspection is not possible, a volumetric inspection will be performed." If any evidence of degradation is observed during visual inspection, a volumetric examination of the affected area will be performed. Additionally, the applicant stated that, for the diesel fire pump fuel oil tank inspection, it will continue to drain and flush the tank, as well as inspect the tank at its defined frequency at the time of the enhancement implementation, until a preventative maintenance evaluation of results from fuel oil samples and tank inspections indicates that the system will be capable of continuing to perform its function during the period of extended operation with a lower frequency, not less than once per a 10-year interval for cleaning and internal visual inspection consistent with GALL Report. The staff reviewed this enhancement against the corresponding program element 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 AMP.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M30. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," 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 Diesel Fuel Monitoring Program.

In April 2000, it was suspected that the fuel in the CTG fuel oil storage tank was contaminated, therefore, it was drained, cleaned, and inspected. Minor pitting was repaired, and an epoxy liner was installed on the tank floor to protect against further pitting. The applicant instituted measures to periodically drain and inspect the tank internals.

In 2009, the applicant amended the program to require multi-level samples of the CTG and EDG main fuel oil storage tanks rather than a single sample from the bottom of the tank. The multi-level stratification sampling is performed annually.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M30 was evaluated.

UFSAR Supplement. As amended by letter dated May 19, 2015, LRA Section A.1.14 provides the UFSAR supplement for the Diesel Fuel Monitoring Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before September 20, 2024, or at the end of the last RFO before March 20, 2025, whichever is later. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Diesel Fuel Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 External Surfaces Monitoring

Summary of Technical Information in the Application. As amended by letters dated July 30, 2014; January 28, 2015; and June 18, 2015, LRA Section B.1.16 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, fouling, changes in material properties, and degradation of thermal insulation due to moisture intrusion. 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” 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” 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. The applicant’s External Surfaces Monitoring Program also includes this activity. LRA Tables 3.3.2-3, 3.3.2-10, and 3.3.2-11 contain AMR items for gas-filled outdoor stainless steel and aluminum components that are managed for cracking. For components that have a gaseous internal environment, it was not clear to the staff how walkdowns of external surfaces will effectively use leakage as an indicator of cracking. By letter dated December 19, 2014, the staff issued RAI B.1.16-1 requesting that the applicant state the parameters inspected and the inspection methods that will be used to determine whether cracking is present on these components.

In its response dated January 28, 2015, the applicant stated that alternate detection methods will be used to detect cracks in gas-filled aluminum and stainless steel components when visual inspections are ineffective. The response addressed each LRA table in question as follows:

- Table 3.3.2-3. The aluminum and stainless steel components in the service water system that are managed for cracking are pressurized using bottled nitrogen. System pressure readings and bottle replacement frequencies are recorded daily and trended to identify the development of adverse trends. Trending of the daily pressure readings and bottle replacement frequencies will be used to detect leakage and as an indication of cracking.

- Table 3.3.2-10. The EDG system contains a stainless steel expansion joint for which cracking is managed. The expansion joint is internally exposed to exhaust gas and externally exposed to outdoor air. The applicant stated that leaking exhaust gas will stain the stainless steel surface. The expansion joint will be visually inspected for staining, in accordance with GALL Report AMP XI.M36.
- Table 3.3.2-11. The aluminum and stainless steel components in the heating, ventilation, and air conditioning (HVAC) system that are managed for cracking will be visually inspected. The periodic visual inspections will be conducted using a soap solution with the system pressurized. LRA Sections A.1.16 and B.1.16 were revised to state that alternate detection methods will be used to detect cracks in gas-filled aluminum and stainless steel components when visual inspections are ineffective.

Commitment No. 11g and Enhancement 7 were added to revise the plant-specific procedures to include instructions for detection of cracks in gas-filled aluminum and stainless steel components.

The staff finds the applicant's response acceptable because visual inspections augmented with the use of a soap solution and trending performance data are methods capable of detecting cracking before loss of intended function. In addition, conducting visual inspections of the EDG system is consistent with GALL Report AMP XI.M36 because leakage will be evident by discoloration of the surface of the stainless steel material. The staff's concern described in RAI B.1.16-1 is resolved.

The "detection of aging effects" program element in GALL Report AMP XI.M36, as revised by LR-ISG-2012-02, recommends managing reduced thermal insulation resistance due to moisture intrusion by visual inspections of insulation jacketing to ensure that there is no damage that would allow moisture inleakage. The applicant's External Surfaces Monitoring Program does not include this activity; instead, the LRA credits the Structures Monitoring Program to manage this aging effect. It was unclear to the staff what activities in the Structures Monitoring Program would be used to manage reduced thermal insulation resistance. By letter dated December 19, 2014, the staff issued RAI B.1.16-2 requesting that the applicant describe the insulation configuration and the activities in the Structures Monitoring Program that will be used to manage reduced thermal insulation resistance due to moisture intrusion.

In its response dated January 28, 2015, the applicant stated that the insulation installation specifications contain configuration controls for insulation jacketing that include minimum overlap and seam locations. In addition, the AMR items that cited the Structures Monitoring Program to manage the aging effect of reduced thermal insulation resistance due to moisture intrusion have been revised to reference the External Surfaces Monitoring Program. Revisions to LRA Sections A.1.16 and B.1.16 state that the inspections of insulated components will be conducted to ensure that moisture intrusion has not degraded the insulation when it is required to reduce heat transfer. Commitment No. 11h and Enhancement 8 were added to revise the plant-specific procedures to include instructions for the inspection of both jacketed and nonjacketed insulation.

The staff finds the applicant's response acceptable, in part, because the applicant revised LRA Table 3.5.2-2 to manage degradation of insulation due to moisture intrusion with the External Surfaces Monitoring Program. However, the response did not state an inspection methodology and frequency for the nonjacketed insulation. By letter dated March 20, 2015, the staff issued RAI B.1.16-2a requesting that the applicant provide the inspection methodology and frequency used to inspect nonjacketed insulation.

In its response dated June 18, 2015, the applicant stated that both jacketed and nonjacketed insulation will be periodically visually inspected in accordance with the External Surfaces Monitoring Program and at a frequency consistent with GALL Report AMP XI.M36, as modified by LR-ISG-2012-02. LRA Section A.1.16, B.1.16, Enhancement 5, Enhancement 8, Commitment No. 11e, and Commitment No. 11h have been revised to reflect these changes.

The applicant also stated that thermography will be performed on at least 20 percent of the population for nonjacketed insulation where plant conditions permit (i.e., the insulated pipe is carrying a heat load and is not located in a high-radiation area) to assess insulating ability. These inspections will begin 5 years before entering the period of extended operation and every 5 years after using the Periodic Surveillance and Preventive Maintenance Program. LRA Sections A.1.35 and B.1.35 have been revised to reflect these changes to the program. SER Section 3.0.3.3.1 documents the staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program.

The staff noted that the "detection of aging effects" program element in LR-ISG-2012-02 states that inspections are conducted at a frequency not to exceed one refueling cycle to accommodate components located in areas accessible only during outages, such as high dose areas. The program element further states that components that are not accessible during either plant operation or RFOs are inspected at a frequency that ensures that the intended functions are maintained and whenever such components are made accessible. The staff finds the applicant's response acceptable because periodic visual examinations will be conducted to detect degradation of insulation due to moisture intrusion for both jacketed and nonjacketed insulation. The frequency of the periodic visual inspections is consistent with GALL Report AMP XI.M36, as modified by LR-ISG-2012-02. In addition, nonjacketed insulation will also be inspected using thermography, which is capable of evaluating the effectiveness of the insulation. The applicant has also revised the applicable sections of the LRA to reflect these changes. The staff's concern described in RAI B.1.16-2a is resolved.

In reviewing the program for consistency with the GALL Report, the staff notes that the program includes fouling as an aging effect requiring management; however, management of fouling is not consistent with GALL Report AMP XI.M36. The program proposes to manage reduction of heat transfer due to air-side fouling of heat exchanger fins and tubes by using periodic visual inspections of external surfaces during system inspections and walkdowns. The staff notes that GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," includes periodic air-side visual inspections to ensure cleanliness of air-to-water heat exchangers as an acceptable approach for verifying heat transfer capability. The staff considers cleanliness of heat exchanger tubes and fins to be readily identifiable using periodic visual inspections during system inspections and walkdowns. Based on this assertion, and as documented in SER Section 3.2.2.3.4, the staff finds that the visual inspections in this program are capable of detecting fouling of air-side heat exchanger surfaces before loss of the intended function.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "administrative controls" 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 “scope of program” program element. In this enhancement, the applicant stated that the plant-specific procedures will be revised to clarify that periodic inspections will be performed for in-scope components in accordance with the requirements of 10 CFR 54.4(a)(1), (a)(2), and (a)(3). The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M36 and finds it acceptable because, when it is implemented, it will provide clarifying guidance in plant-specific procedures to ensure that the scope of inspections in the program will be in accordance with 10 CFR 54.4, “Scope,” and consistent with the GALL Report recommendations.

Enhancement 2. LRA Section B.1.16 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements. In this enhancement, the applicant stated that plant-specific procedures will be revised to inspect 100 percent of accessible components at least once per refueling cycle. The Program Description of the AMP states that “[s]urfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at such intervals that would ensure the components’ intended functions are maintained.” The applicant also stated that plant-specific procedures will be revised to include instructions on the parameters to be inspected for metallic components. The staff noted that the proposed parameters monitored are consistent with those in GALL Report AMP XI.M36. 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 extent of inspections, frequency of inspections, and parameters monitored will be consistent with the GALL Report recommendations.

Enhancement 3. LRA Section B.1.16 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements. In this enhancement, the applicant stated that plant-specific procedures will be revised to include instructions for inspecting flexible polymeric components, including a 10-percent minimum sample size for physical manipulation and parameters to be monitored. The staff noted that the proposed parameters monitored are consistent with those in GALL Report AMP XI.M36 for all polymers. 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 extent of inspections and parameters monitored for polymers will be consistent with the GALL Report recommendations.

Enhancement 4. LRA Section B.1.16, as amended by letter dated July 30, 2014, 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 the inspection of insulated components. Specifically, the enhancement includes periodic inspections during each 10-year period of a representative sample of components that are insulated and that may be exposed to moisture (i.e., outdoors or indoors where condensation may occur). The enhancement also includes provisions for conducting followup inspections of either outer insulation surfaces or bare-metal surfaces, depending on whether prior inspections detect degradation or moisture intrusion. The enhancement further includes guidance for the inspection of components with tightly adhering insulation. The staff noted that the details of the enhancement are consistent with the inspections of insulated components recommended by GALL Report AMP XI.M36, as revised by LR-ISG-2012-02. 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 insulated components will be consistent with the GALL Report recommendations.

Enhancement 5. LRA Section B.1.16, as amended by letter dated June 18, 2015, includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that plant-specific procedures will be revised to include acceptance criteria for metals and polymers. Acceptance criteria for insulation include verification that no discoloration, staining, or surface irregularities from moisture intrusion are observed. The staff noted that the applicant's proposed acceptance criteria are consistent with those in GALL Report AMP XI.M36. 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 acceptance criteria will be consistent with the GALL Report recommendations.

Enhancement 6. LRA Section B.1.16 includes an enhancement to the "administrative controls" program element. In this enhancement, the applicant stated that plant-specific procedures will be revised to state that administrative controls will be in accordance with the plant's QA program under Appendix B to 10 CFR Part 50. The staff noted that the "administrative controls" program element of GALL Report AMP XI.M36 states that the requirements of Appendix B to 10 CFR Part 50 are acceptable to address the administrative controls. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M36 and finds it acceptable because, when it is implemented, the administrative controls for the External Surfaces Monitoring Program will be consistent with the GALL Report recommendations.

Enhancement 7. As amended by letter dated January 28, 2015, LRA Section B.1.16 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that plant-specific procedures will be revised to include instructions for the detection of cracking of gas-filled aluminum and stainless steel components exposed to outdoor air. RAI B.1.16-1 documents the staff's evaluation of this enhancement.

Enhancement 8. LRA Section B.1.16, as amended by letters dated January 28, 2015, and June 18, 2015, includes an enhancement to the "detection of aging effects" and "parameters monitored and inspected" program elements. In this enhancement, the applicant stated that jacketed and nonjacketed insulation will be visually inspected for evidence of moisture intrusion at a frequency consistent with GALL Report AMP XI.M36, as modified by LR-ISG-2012-02. The enhancement also states that the plant-specific procedures will be revised to include instructions to inspect for signs of water intrusion. RAI B.1.16-2a documents the staff's evaluation of this enhancement.

Operating Experience. LRA Section B.1.16 summarizes operating experience related to the External Surfaces Monitoring Program. The LRA describes instances in which piping component leaks, a bulging air seal gasket, and missing piping insulation were discovered during system walkdowns from 2009 to 2012.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M36 was evaluated.

UFSAR Supplement. As amended by letter dated June 18, 2015, LRA Section A.1.16 provides the UFSAR supplement for the External Surfaces Monitoring Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as revised by LR-ISG-2012-02. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Fatigue Monitoring

Summary of Technical Information in the Application. LRA Section B.1.17, as amended by letters dated June 26, 2015, and March 10, 2016, describes the existing Fatigue Monitoring Program as consistent, with an exception and enhancements, with GALL Report AMP X.M1, "Fatigue Monitoring." The LRA states that the AMP ensures that the fatigue usage remains within allowable limits for components identified to have fatigue-related TLAAs. The LRA also states that the AMP (a) tracks plant transients that cause significant fatigue usage, (b) verifies that the severity of the transients being monitored are bounded by the design transients for which they are classified, and (c) assesses the impact of the reactor coolant environment on a sample of critical and limiting components. The LRA further states that fatigue usage factors will be updated if transient definitions change, new thermal events are discovered, or component geometries are modified. Additionally, as an alternative to monitoring the occurrences of transients, the LRA states that the program will include stress-based fatigue (SBF) monitoring.

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.

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 X.M1 recommends tracking the number of each plant transient; however, it does not provide guidance on the use of a specific fatigue monitoring method. During its audit, the staff found that the applicant's Fatigue Monitoring Program states that the "cycle counting" method of fatigue monitoring will be used to track the number of occurrences for plant transients. The staff also noted that the LRA states that fatigue usage calculations will be updated using refined fatigue analysis to determine valid CUFs of less than 1.0 for locations in LRA Table 4.3-8 that are projected to exceed the limit of 1.0. However, it was not clear if fatigue monitoring methods other than "cycle counting" are being used to prevent the fatigue design limit of components from being exceeded. By letter dated January 14, 2015, the staff issued RAI 4.3.3-1, requesting that the applicant clarify the methodology used to refine the fatigue analysis to ensure that the CUF values projected to exceed 1.0 will remain within the ASME Code limit.

In its response dated February 12, 2015, the applicant stated that several options may be used to ensure that the CUF values do not exceed the limit of 1.0. The options include implementing cycle-based fatigue (CBF) and SBF monitoring methods when accounting for environmental effects. The applicant also stated that the recommendations provided in Regulatory Issue Summary 2008-30, "Fatigue Analysis of Nuclear Power Plant Components," dated December 16, 2008, will be applied when using the SBF monitoring method. The applicant has revised LRA Sections A.1.17 and B.1.17 to state that SBF monitoring will compute the stress history for a given component using transient pressure and temperature data collected from plant instrumentation. The LRA also states that the computed stress history will then be used to compute a CUF. Additionally, the applicant revised Enhancement 4 and Commitment No. 12 to include CBF and SBF for EAF calculations.

The staff finds the applicant's response acceptable because the CBF and SBF monitoring methods are consistent with the guidance provided in GALL Report AMP X.M1. GALL Report AMP X.M1 states that the number of occurrences of plant transients or detailed local pressure and thermal conditions should be monitored to allow for calculation of the fatigue usage. The CBF method uses accumulated cycles to determine whether the CUF. The SBF method uses transient pressure and temperature data collected from plant instrumentation to determine a local stress history. The applicant has revised the Fatigue Monitoring Program to include the CBF and SBF monitoring methods. The staff's full evaluation of RAI 4.3.3-1 is in SER Section 4.3.3. The staff's concern described in RAI 4.3.3-1 is resolved.

During its review of LRA Sections 4.1 and 4.7, the staff noted that the Fatigue Monitoring Program was being used to track cumulative operating time to ensure that a "cumulative usage time limit" associated with a flaw evaluation TLAA is not exceeded. It was unclear if flaw evaluation analyses and tracking events, other than plant design transients, were within the scope of the Fatigue Monitoring Program. By letter dated December 17, 2014, the staff issued RAI B.1.17-2, requesting that the applicant identify TLAAs that will use the Fatigue Monitoring Program to ensure that any analysis or design limit, other than a fatigue usage factor for crack initiation, is not exceeded during the period of extended operation. The RAI also requested that the applicant identify events and cycles that will be tracked by the Fatigue Monitoring Program that are not plant design transients. The applicant's response to RAI B.17-2 resulted in revisions to the Fatigue Monitoring Program. The aspects of the response that relate to the Fatigue Monitoring Program are discussed below.

In its response dated January 20, 2015, the applicant stated that there are two TLAAs that will use the Fatigue Monitoring Program to ensure that an analysis or design limit, other than a fatigue usage factor for crack initiation, is not exceeded during the period of extended operation. The two TLAAs identified are (1) the "Determination of High-Energy Line Break Locations" (LRA Section 4.7.2) and (2) the "Main Steam Bypass Lines Cumulative Operating Time" (LRA Section 4.7.6). The response also states that the only event that is not a design transient being tracked by the Fatigue Monitoring Program is the number of days of operation at 30 percent to 45 percent open for the main steam bypass line.

The Determination of HELB Locations TLAA calculates a CUF in accordance with ASME Code Section III. The Fatigue Monitoring Program is used to track design transients to ensure that a CUF limit of 0.1 is not exceeded for this TLAA. Exception 1 of the Fatigue Monitoring Program states that corrective action will be taken for the HELB locations before a limit of 0.1 is reached instead of the ASME Code fatigue crack initiation design limit of 1.0. SER Section 4.7.2 discusses the staff's evaluation of the applicant's HELB TLAA.

The staff finds the applicant's response for the Determination of HELB Locations TLAA acceptable because (1) the CUF is determined using design transients and in accordance with ASME Code Section III and (2) Exception 1 modifies the Fatigue Monitoring Program to ensure that corrective actions will be taken before the limit of 0.1 is reached.

The Main Steam Bypass Lines Cumulative Operating Time TLAA is not a fatigue usage analysis. This TLAA is a flaw evaluation analysis. The TLAA analysis entails the determination of an operating time limit. The operating time limit is used to establish a cumulative operating time factor with a limit of 1.0. The Fatigue Monitoring Program is being used to track the number of days of operation at 30 percent to 45 percent open for the main steam bypass line. Days of operation at the 30 percent to 45 percent open is not a design transient. In its RAI response, the applicant also added Enhancement 5 to prevent the cumulative operating time limit from being exceeded during the period of extended operation, and it committed (Commitment Nos. 12e and 12f) to implementing the enhancement before entering the period of extended operation. Enhancement 5 was subsequently separated into Enhancement 5 and Enhancement 6, by letter dated June 26, 2015, for administrative purposes without any technical changes. SER Section 4.7.6 discusses the staff's evaluation of the applicant's Main Steam Bypass Lines Cumulative Operating Time TLAA.

The staff finds the applicant's response for the Main Steam Bypass Lines Cumulative Operating Time TLAA acceptable because the Fatigue Monitoring Program has been enhanced to track the applicable plant events and to prevent the cumulative operating time limit from being exceeded. Enhancement 5 and Enhancement 6 expand 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's concern described in RAI B.1.17-2 is resolved.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements associated with the exception and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the exception and enhancements follows.

Exception. LRA Section B.1.17 includes an exception to the "corrective actions" program element. The exception is the use of a CUF limit of 0.1 instead of 1.0 to initiate a corrective action for the HELB locations. In this exception, the applicant stated that an additional corrective action will be applied to the HELB locations. The LRA also states that this corrective action is based on a fatigue usage limit value of 0.1. The staff reviewed this exception against the corresponding program element in GALL Report AMP X.M1 and finds it acceptable because the fatigue usage limit value being applied to the HELB is more conservative than the value recommended by GALL Report AMP X.M1. The staff also noted that the fatigue usage limit value of 0.1 being applied to the HELB is consistent with the UFSAR.

Enhancement 1. LRA Section B.1.17 includes an enhancement to the “scope of program,” “preventive actions,” “parameters monitored or inspected,” and “monitoring and trending” program elements. In this enhancement, the applicant stated that the procedures of the AMP will be revised to monitor transients for components that have been identified as TLAAs. 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 thermal and pressure transients being tracked are consistent with the GALL Report recommendations.

Enhancement 2. LRA Section B.1.17 includes an enhancement to the “scope of program,” “preventive actions,” and “acceptance criteria” program elements. In this enhancement, the applicant stated that EAF usage calculations that consider the effects of the reactor coolant environment will be developed for select locations. The enhancement states that the select locations will consist of those identified in NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,” dated February 1995, and a sample of more limiting plant-specific locations in the reactor coolant pressure boundary. 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 EAF usage factors are calculated in a manner consistent with the GALL Report guidance.

Enhancement 3. LRA Section B.1.17 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that the procedures of the AMP will be revised to provide updates to the fatigue usage calculation on an as needed basis. The enhancement states that events that will prompt the updates to the fatigue usage calculation include (a) the approach of an allowable cycle limit, (b) a change in transient definitions, (c) the discovery of new thermal events, or (d) the modification of component geometries. 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 fatigue usage factors remain valid and below the design limit in accordance with the GALL Report guidance.

Enhancement 4. LRA Section B.1.17, as amended by letter dated February 12, 2015, includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that the procedures of the AMP will be revised to maintain the EAF usage factor below the design limit. The applicant also stated that the procedures of the AMP will be revised to allow for the use of the CBF and SBF monitoring methods if EAF usage factors are predicted to exceed the limit of 1.0. 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 prevent the EAF usage factor from exceeding 1.0 in accordance with the GALL Report guidance.

Enhancement 5. LRA Section B.1.17, as amended by letter dated June 26, 2015, includes an enhancement to the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements. In this enhancement, the applicant stated that the procedures of the AMP will be revised to include monitoring of the main steam bypass valve operation at the 30-percent to 45-percent open position and trending to ensure that the cumulative operating time remains below the established limit. 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 prevent the cumulative operating time limit from being exceeded during the period of extended operation.

Enhancement 6. LRA Section B.1.17, as amended by letter dated June 26, 2015, includes an enhancement to the “corrective actions” program elements. In this enhancement, the applicant stated that the procedures of the AMP will be revised to provide corrective actions to prevent the operating time limit of the main steam bypass valve in the 30-percent to 45-percent open position from being exceeded during the period of extended operation. The enhancement states that acceptable corrective actions include component repair, component replacement, or more rigorous analysis to demonstrate that the service life will not be exceeded. 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 corrective actions are taken before the operating time limit is reached ensuring that the service life of the main steam bypass valve is not exceeded during the period of extended operation. The content of this enhancement was originally added to the AMP in response to RAI B.1.17-2 and encompassed within Enhancement 5. Enhancement 6 was subsequently created by the applicant because these activities are only associated with the “corrective actions” program element of the AMP and do not affect the other program elements in Enhancement 5.

Based on its audit and review of the applicant’s response to RAI 4.3.3-1 and RAI B.1.17-2, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP X.M1. The staff also reviewed the exception associated with the “acceptance criteria” 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,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.17 summarizes operating experience related to the Fatigue Monitoring Program. The LRA describes an instance in which the transient cycle count was approaching the cycle limits for a component, and corrective measures were successfully taken. The LRA also states that a component at the facility has never experienced the loss of intended function due to thermally induced fatigue.

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

UFSAR Supplement. LRA Section A.1.17, as amended by letter dated February 12, 2015, provides the UFSAR supplement for the Fatigue Monitoring Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 12) to implement Enhancements 1, 3, 4, 5, and 6 before September 20, 2024, and Enhancement 2 at least 2 years before March 20, 2025.

The staff finds that the information in the UFSAR supplement, as amended by letter dated February 12, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Fatigue Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fire Protection

Summary of Technical Information in the Application. As amended by letter dated January 15, 2015, LRA Section B.1.18 describes the existing Fire Protection Program as consistent, with enhancements, with GALL Report AMP XI.M26, "Fire Protection." The LRA states that the program manages the following aging effects for the SCs with a fire barrier intended function: cracking and loss of material for concrete components and masonry walls; loss of material for carbon steel components; loss of material, change in material properties, cracking, delamination, and separation for fire resistant materials; and increased hardness, shrinkage, and loss of strength for elastomer components. The program includes visual inspections of not less than 10 percent of each type of penetration seal; visual inspections of fire barrier walls, ceilings, and floors in structures within the scope of license renewal; periodic visual and functional testing of fire doors; and visual and functional tests of the carbon dioxide (CO_2) and Halon systems. The frequencies of the inspections and testing are in accordance with the applicant's Technical Requirements Manual (TRM).

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.

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.M26 recommends that visual inspections of fire barrier materials be conducted at a frequency in accordance with an NRC-approved fire protection program. However, during its audit, the staff noted that the applicant's existing Fire Protection Program includes visual inspection of all fire-rated assemblies (e.g., fire damper housings), separating safety-related fire areas or separating portions of redundant systems important to safe shutdown within a fire area, every 18 months in accordance with the TRM. The applicant proposes to manage aging of fire damper housings using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the External Surfaces Monitoring Program. The inspection frequency for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is based on a sampling of at least 20 percent or maximum of 25 components every 10 years. The frequency and scope of this inspection is less than what is currently required by the TRM. Therefore, by letter dated December 17, 2014, the staff issued RAI B.1.18-1 requesting that the applicant explain why the frequency and number of inspections for fire damper housings using the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," program is adequate given the requirements in the TRM.

In its response dated January 15, 2015, the applicant indicated that it will continue to comply with TRM Section TRSR 3.12.8.6 and to perform visual inspections of each fire damper housing and that such inspections will also be credited to meet the inspection recommendations in both the Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the External Surfaces Monitoring Program.

The staff finds the applicant's response acceptable because the applicant will continue to comply with the requirements in its TRM for frequency of inspection of the fire damper housings. The inspections required by the TRM are the same type as those recommended in the two AMPs. Because the frequency and number of inspections required by the TRM is greater than or equal to those recommended by the two credited AMPs, the staff's concern described in RAI B.1.18-1 is resolved.

The staff also reviewed the portions of the "scope of program" 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.1.18 includes an enhancement to the "scope of program" and "detection of aging effects" program elements. In this enhancement, the applicant stated that it will revise procedures to perform visual inspections of the Halon and CO_2 fire suppression systems. 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 make the program consistent with the recommendations in the GALL Report to perform visual inspections of these systems to detect any sign of corrosion.

Enhancement 2. LRA Section B.1.18, as amended by letter dated January 15, 2015, includes an enhancement to the "detection of aging effects" program elements. In this enhancement, the applicant stated that it will revise procedures to perform visual inspections of fire wrap and fire stop materials, carbon steel penetration sleeves, steel framing, roof decking, floor decking, concrete fire barriers, and railroad bay airlock doors at a frequency consistent with the NRC-approved fire protection program or at least once every refueling cycle. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M26 and finds it acceptable because, when it is implemented, it will make the program consistent with the recommendations in the GALL Report to perform visual inspections of these components to detect any signs of degradation.

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. 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.1.18 summarizes operating experience related to the Fire Protection Program.

Nuclear Electric Insurance Limited reports from October 2011, September 2012, and October 2013 did not identify any issues related to aging of fire barriers or fire protection features or any issues related to the CO_2 system.

Fermi 2 personnel identified small holes in fire doors, damaged fire door seals, damaged fire walls, or damaged penetrations seals. According to the LRA, when deficiencies are noted, a fire impairment is declared, and maintenance personnel repair the deficiency.

In 2009, the applicant found that eight fire penetration seals in the reactor building steam tunnel floor were cracked due to heat stress. The applicant prepared a fire protection engineering evaluation (FPEE) that documented the historical record of the failure of these seals and the acceptability of the fire barrier penetration seals between the turbine building and the torus room. The FPEE concluded that the seals deviated from their rated design because they were used in conditions beyond their design capabilities due to their exposure to pipe movement and extreme temperatures during normal plant operations. However, the FPEE further concluded that the seals were acceptable due to the extremely low fire loading in the area and the presence of an automatic sprinkler system below the steam tunnel in the reactor building basement.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M26 was evaluated.

UFSAR Supplement. LRA Section A.1.18 provides the UFSAR supplement for the Fire Protection Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before September 20, 2024. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Fire Protection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Fire Water System

Summary of Technical Information in the Application. As amended by letters dated July 30, 2014; January 15, 2015; and April 10, 2015, LRA Section B.1.19 describes the existing Fire Water System Program as consistent, with exceptions and enhancements, with GALL Report AMP XI.M27, "Fire Water System," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation." The LRA states that the AMP addresses water-based fire suppression system components to manage loss of material, fouling, and flow blockage. The LRA also states that when using visual inspections to detect loss of material, the inspection techniques will also be capable of detecting corrosion product deposition and flow blockage due to fouling. The LRA further states that the AMP proposes to manage these aging effects through periodic flow tests, visual inspections, sprinkler testing, and volumetric wall thickness evaluations.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M27, "Fire Water System," as modified by LR-ISG-2012-02.

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 LR-ISG-2012-02 AMP XI.M27 recommends that, as stated in NFPA 25 Section 5.2.1.1.2, sprinklers that exhibit corrosion should be replaced. However, during its audit, the staff found that the applicant's Fire Water System Program and plant-specific procedures for inspecting sprinklers do not include an acceptance criteria associated with corrosion of sprinklers. By letter dated December 17, 2014, the staff issued RAI B.1.19-7 requesting that the applicant state the basis for why a corroded sprinkler will be capable of performing its CLB intended function during the period of extended operation.

In its response dated January 15, 2015, the applicant revised LRA Section B.1.19 to include an enhancement, Enhancement 16, which states that corroded fire sprinklers will be replaced.

The staff finds the applicant's response acceptable because the enhancement is consistent with LR-ISG-2012-02 AMP XI.M27, which ensures that corrosion on sprinklers will be corrected by replacement. The staff's concern described in RAI B.1.19-7 is resolved.

The staff also reviewed the portions of the "parameters monitored or inspected," and "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. As amended by letter dated July 30, 2014, LRA Section B.1.19 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it will perform sprinkler inspections on a refueling cycle interval (i.e., 18 months) in lieu of annual testing specified by Section 5.2.1 of NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," (hereinafter, unless noted otherwise, the 2011 Edition). The applicant also stated that the refueling cycle inspection interval has been effective at maintaining component intended function.

NFPA 25 was written for a broad range of facilities, including those with a few sprinklers (e.g., a small manufacturing facility with only a dozen sprinklers) and those with numerous sprinklers (as is typical for power plants). The staff reviewed this exception against the corresponding program element in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because the applicant stated that the refueling cycle inspection interval has not resulted in a loss of intended functions in the past. In addition, the staff's independent search of plant-specific operating experience during the audit did not reveal any evidence that sprinkler degradation was occurring, and there are a sufficient number of sprinklers installed in commercial nuclear power plants to establish an adverse performance trend, even with plant-specific inspections being completed on a refueling cycle basis rather than annually.

Exception 2. As amended by letter dated July 30, 2014, LRA Section B.1.19 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that sprinklers will not be inspected for orientation, foreign material, physical damage, and loading due to dust or debris as specified by NFPA 25 Section 5.2.1.1. The staff reviewed this exception against the corresponding program element in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because the excluded inspection results are not associated with aging effects.

Exception 3. As amended by letter dated July 30, 2014, LRA Section B.1.19 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it will not perform flow testing at the hydraulically most remote hose connections of each zone of an automatic standpipe system to verify that the water supply provides the design pressure as specified by NFPA 25 Section 6.3.1. The applicant also stated that it conducts (a) flow testing in the main headers that supply the standpipe system to verify that design pressure and required flow are met; (b) testing on the fire water hoses listed in the Technical Requirements Manual every 3 years by flowing several gallons of water to ensure there are no indications of obstruction or undue restriction; (c) flow tests at hose stations, including approximately 15 in the Auxiliary Building, 33 in the Reactor Building, and 8 in the RHR Complex; and (d) a "version" of a main drain test in each building every 18 months on a portion of the deluge and sprinkler systems. The applicant further stated the following:

> Fermi 2 also flow tests the wet pipe sprinkler systems through 14 inspector test valves and 7 main drain valves in the Reactor Building, Auxiliary Building and RHR Complex. For 6 of those locations that are flowed through the inspector test valve and main drain valve, the difference between static and flowing pressure is recorded and two of those locations are flowed through a sample collection sock. Any debris found in the sample collection sock is representative of what is in the rest of the system. Similar tests are also performed for the balance of the plant.

The applicant further stated that NFPA 25 (2014 Edition) Section 6.3.1 has been revised to state that the testing is only applicable to Class I and Class III standpipe systems and that its automatic standpipe system is Class II.

NFPA 25 Section 6.3.1 requires that flow testing be conducted every 5 years. The purpose of the flow tests is 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 fire water system main header flow testing and flow confirmation at each hose station every 3 years. In relation to Item (c) above, during the audit, the staff determined that flow is verified but not measured at hose stations.

The staff reviewed this exception against the corresponding program element in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because the proposed alternative testing is sufficient to establish reasonable assurance that flow blockage will be detected before a CLB intended function not being met. The staff based this conclusion on the following: (a) the alternative flow verifications (in number, breadth of locations, and frequency), which provide insights concerning potential accumulation of corrosion products that are comparable to insights gained from the test recommended in LR-ISG-2012-02 AMP XI.M27, (b) the number of tests conducted (i.e., main header flow testing is conducted every 3 years, 64 hose stations are tested every 3 years to verify no flow blockage, and multiple main drain tests are conducted every 18 months), (c) the breadth of testing, which will encompass piping located in three different buildings, (d) the frequency of testing, with alternative tests conducted more frequently than every 5 years, and (e) removal by NFPA 25 (2014 Edition) (an industry consensus document) of the requirement to conduct the test for the class of standpipe used at the station.

Exception 4. As amended by letter dated July 30, 2014, LRA Section B.1.19 includes an exception to the “detection of aging effects” program element. In this exception, the applicant stated that it does not perform main drain tests on all standpipes and risers as specified by NFPA 25 Sections 6.3.1.5 and 13.2.5. The applicant stated that it performs seven main drain tests throughout the plant. The tests are conducted to verify that there has not been a change in supply piping internal conditions and control valves.

Several GALL Report AMPs (e.g., XI.M32, XI.M33) base the inspection population size on either 20 percent or a maximum of 25 components of each material, environment, and aging effect combination. NFPA 25 Sections 13.2.5 and 13.2.5.1 (2014 Edition) allows the conduct of a reduced number of main drain tests. Specifically, where the lead-in to a building supplies a header or manifold serving multiple systems, a single main drain test is allowed.

During the audit, the staff confirmed that there are 28 main drain test locations within the in-scope buildings protected by the fire protection water system. The staff also confirmed that the applicant conducts main drain tests in accordance with NFPA 25 at locations in the reactor building, auxiliary building, and general service water pump house building.

The staff reviewed this exception against the corresponding program element in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, although the applicant has not proposed to conduct main drain tests in each water-based fire protection system riser, the proposed alternative testing is sufficient to establish reasonable assurance that flow blockage will be detected before a CLB intended function not being met. The staff based this conclusion on the following: (a) the main drain tests, both in number and scope of locations, provide insights concerning potential accumulation of corrosion products that are sufficient from a sampling basis, (b) the applicant proposed to periodically perform seven main drain tests, which exceeds the 20-percent sampling size criterion cited in random sampling programs recommended in GALL Report AMPs XI.M32, XI.M33, and XI.M38, and (c) the testing locations encompass piping located in three different buildings.

Exception 5. As amended by letter dated July 30, 2014, LRA Section B.1.19 includes an exception to the “detection of aging effects” program element. In this exception, the applicant stated that the calibration of gauges (NFPA 25 Section 6.3.1.5.2) is not addressed in the Fire Water System Program because they are active components. The staff reviewed this exception against the corresponding program element in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because calibration of test equipment is not addressed in LR-ISG-2012-02 AMP XI.M27 and the staff recognizes that calibration of gauges is controlled by plant-specific procedures.

Exception 6. As amended by letter dated July 30, 2014, LRA Section B.1.19 includes an exception to the “detection of aging effects” program element. In this exception, the applicant stated that it does not conduct inspections and cleaning of the suction screens for the fire water pumps after the annual flow test or fire protection activation as specified by NFPA 25 Sections 8.3.3.7 and 14.3.1 (1). The applicant also stated that it conducts routine inspections of the intake structure screens (water source for the fire water system), annual inspections of the fire water pump suction screens, inspections of the diesel driven fire water pump discharge strainer on 18-month intervals, and inspections of the electric-driven fire water pump discharge strainer on 3-year intervals.

NFPA 25 Section 14.3.1 (1) specifies that an obstruction inspection should be conducted if a “defective intake for fire pumps taking suction from open bodies of water” is detected. The staff determined that the purpose of inspecting the pump suction screens from a license renewal perspective is to provide insights into the condition of the internal surfaces of the fire water piping (see footnote 1 to LR-ISG-2012-02 AMP XI.M27, Table 4a). Periodic inspection of the intake structure screens ensures that external foreign material is not entering the system; however, foreign debris from the lake would not be associated with age-related degradation of the internal surfaces of the fire water piping. Therefore, the staff finds it acceptable that the applicant took exception to NFPA 25 Section 14.3.1 (1). The staff reviewed the exception to NFPA 25 Section 8.3.3.7 against the corresponding program element in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because the applicant will periodically inspect both the suction screens and discharge strainers; therefore, the number and periodicity of inspections is sufficient to provide insights into the internal surface conditions of the fire water piping.

Exception 7. As amended by letters dated July 30, 2014; January 15, 2015; and April 10, 2015, LRA Section B.1.19 includes an exception to the “detection of aging effects” program element. In this exception, the applicant stated that it performs full flow testing of the piping downstream of the deluge valves associated with transformers at least once each RFO, but it does not perform an internal inspection on the dry piping downstream of the deluge valves. The applicant also stated that it does not inspect the dry lines downstream of the manual isolation valves for the control center HVAC makeup filter charcoal filter absorber unit, control center HVAC recirculation filter charcoal absorber unit, and the manual wet pipe cable spreading room fire water supply, as specified by NFPA 25 Section 14.2 (5-year inspection of wet and dry fire water piping). The applicant further stated that, in lieu of performing these inspections, the "piping and the nozzles associated with the charcoal absorber unit will be internally inspected when the charcoal is replaced."

LR-ISG-2012-02 AMP XI.M27, Table 4a, and NFPA 25 Section 13.4.3.2.2.4 state the frequency of testing deluge valves should not exceed every 3 years. It was not clear to the staff that the proposed exception is consistent with LR-ISG-2012-02 AMP XI.M27 because, during the audit, the staff reviewed charcoal filter media replacement work orders and determined that media is replaced approximately every 7 to 10 years. By letter dated December 17, 2014, the staff issued RAI B.1.19-2 requesting that the applicant state the basis for why there is reasonable assurance that the CLB intended function(s) of the deluge systems for the control center HVAC makeup filter charcoal filter absorber unit and the Control Center HVAC recirculation filter charcoal absorber unit will be met during the period of extended operation when inspections do not occur every 3 years.

In its response dated January 15, 2015, the applicant stated that (a) the deluge valves for the control center HVAC makeup filter charcoal filter absorber unit and control center HVAC recirculation filter charcoal absorber unit are manually operated and, therefore, are not subject to NFPA 25 Section 13.4.3.2.2.4 testing, (b) the piping is normally isolated from the wet portion of the fire protection system, (c) the piping is constructed of stainless steel, (d) the suppression system does not have nozzles (e) the water is distributed by a series of holes in the piping, (f) the piping upstream of the manual isolation valve is constructed of carbon steel and "is routinely flushed to ensure no blockage," and (g) "[s]hould obstructive material be found during flow testing, an obstruction investigation would be performed in accordance with NFPA 25 Section 14.3.1 (2)." The applicant revised LRA Sections A.1.19 and B.1.19 to clarify that the charcoal units are adsorbers, not absorbers, and the deluge water is distributed by water distribution piping, not sprinklers.

The staff noted that NFPA 25 Section 13.4.3.2.2.4 states that deluge valves shall be trip tested. The staff finds the applicant's response, in part, acceptable because (a) the isolation valves are manual (i.e., not capable of being trip tested); therefore, they are not within the scope of NFPA 25 Section 13.4.3.2.2.4 and (b) flow blockage due to buildup of corrosion products would not be expected to occur in the stainless steel normally dry portions of the charcoal filter water distribution piping. However, corrosion products could accumulate in the upstream carbon steel piping, and although the applicant stated that this piping is routinely flushed, it did not state the periodicity of these flushes or how they are documented in the CLB. By letter dated March 11, 2015, the staff issued RAI B.1.19-2a requesting that the applicant state and justify the periodicity of the flushing of the carbon steel piping upstream of the control center HVAC makeup filter charcoal filter absorber unit and control center HVAC recirculation filter charcoal absorber unit and state how the periodicity of the flushing is documented in the CLB.

In its response dated April 10, 2015, the applicant stated the steel piping supplying the control center HVAC units is normally isolated and drained. In accordance with the TRM, the isolation valve is opened and closed once every 12 months. The piping is drained after the valve is closed. The applicant also stated that personnel inspect for "particles and other indications of flow blockage" during draining. The applicant further stated that the plant-specific procedure does not require documentation of the inspection of the drain down water; however, an enhancement, Enhancement 12 was added to the program to include formal documentation of the inspection for indications of flow blockage during draining of the steel piping upstream of the control center HVAC units. The applicant revised LRA Sections A.1.19 and B.1.19 and Commitment No. 14 to reflect the new enhancement.

The staff finds the applicant's response acceptable because the annual (more frequent than the 3-year interval for deluge valve testing) drain down of the steel portions of the supply to the control center HVAC units and observation for indications of flow blockage provide reasonable assurance that the distribution holes will not be blocked. The staff's concern described in RAIs B.1.19-2 and B.1.19-2a is resolved.

The applicant also stated that it will perform a one-time inspection of the dry piping downstream of the manual isolation valve for the wet pipe system for the cable spreading room. The applicant further stated that this piping is a backup system for the Halon system that provides fire suppression for the cable spreading room.

LR-ISG-2012-02 AMP XI.M27 recommends the conduct of periodic inspections of fire water system piping that is exposed to indoor air. It was not clear to the staff that the proposed exception is consistent with LR-ISG-2012-02 AMP XI.M27 because the applicant did not provide a basis for why there is reasonable assurance that the CLB intended function(s) of the piping would be met when only a one-time inspection is conducted. By letter dated December 17, 2014, the staff issued RAI B.1.19-1 requesting that the applicant state the basis for why there is reasonable assurance that the CLB intended function(s) of the piping downstream of the manual isolation valve for the wet pipe system for the cable spreading room will be met during the period of extended operation when only a one-time inspection is conducted.

In its response dated January 15, 2015, the applicant revised its Periodic Surveillance and Preventive Maintenance Program to require periodic visual inspections of a representative sample of the dry piping downstream of the manual isolation valve for the cable spreading room wet pipe system to detect potential flow blockage. The inspections will commence within the 5-year period before the period of extended operation and will be conducted every 5 years. The applicant also revised the "acceptance criteria" program element of the Periodic Surveillance and Preventive Maintenance Program to state the following: "[n]o flow blockage due to fouling." In addition, the applicant revised LRA Table 3.3.2-7 to include an AMR item for carbon steel piping exposed to air-indoor being managed for flow blockage due to fouling by the Periodic Surveillance and Preventive Maintenance Program.

The staff finds the applicant's response acceptable because the periodic visual inspections are capable of detecting flow blockage; the periodicity is consistent with NFPA 25 Section 14.2.1, which cites a frequency of 5 years for internal piping inspections; and the "acceptance criteria" program element for the Periodic Surveillance and Preventive Maintenance Program states that flow blockage due to fouling is not acceptable. The staff's concern described in RAI B.1.19-1 is resolved.

The staff reviewed this exception and Enhancements 10 and 18 below against the corresponding program element in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02 and finds it acceptable because the proposed alternative inspections occur on a frequency sufficient to detect potential flow blockage and because the inspection methods are capable of detecting precursors to flow blockage.

Enhancement 1. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to require sprinkler heads to be tested or replaced in accordance with NFPA 25. The staff reviewed this enhancement against the corresponding program elements in

LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when it is implemented, it will be consistent with LR-ISG-2012-02 AMP XI.M27, which recommends testing of sprinkler heads that have been in service for 50 years.

Enhancement 2. As amended by letters dated July 30, 2014, and January 15, 2015, LRA Section B.1.19 states an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to:

> [P]erform an inspection of wet fire water system piping condition at least once every five 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. (Refer to NFPA 25 (2011 Edition) Section 14.2.1).

The applicant also stated that the inspection technique will be capable of detecting surface irregularities that are indicative of loss of material, corrosion product deposition, and flow blockage due to fouling. The applicant further stated that it will conduct followup volumetric wall thickness evaluations where irregularities are detected.

NFPA 25 Section 14.2.2 specifies that, in buildings with multiple wet pipe systems, every other system is inspected every 5 years. During the audit, the applicant confirmed that it has multiple wet pipe systems in buildings with in-scope components protected by the fire water system. The applicant did not provide a basis for why testing only one system every 5 years is sufficient. By letter dated December 17, 2014, the staff issued RAI B.1.19-3 requesting that the applicant state the basis for why inspecting only one of the wet pipe systems in each building every 5 years will provide reasonable assurance that the wet fire water system piping will be capable of performing its CLB intended function(s) during the period of extended operation.

In its response dated January 15, 2015, the applicant revised the enhancement to state that "[w]here multiple wet-pipe systems are in a building every other system shall be inspected in a five year period. Then in the next five year period, the remaining systems in that building shall be inspected."

The staff finds the applicant's response and Enhancements 2 and 7 (below) acceptable because it is consistent with LR-ISG-2012-02 AMP XI.M27 and NFPA 25 Section 14.2.2, which recommend that every other piping system be inspected to ensure that an adequate number of inspections are conducted to ensure that potential flow blockage is detected. The staff's concern described in RAI B.1.19-3 is resolved.

Enhancement 3. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to require that sprinkler heads are tested or replaced in accordance with NFPA 25 and that the fire protection engineer will approve the test laboratory. The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when it is implemented, it will be consistent with LR-ISG-2012-02 AMP XI.M27, which recommends testing of sprinkler heads that have been in service for 50 years.

Enhancement 4. As amended by letters dated July 30, 2014, and January 15, 2015, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to:

> a) address a 10 percent decrease in pressure from one main drain test to the previous main drain test results, b) note the time to return to static pressure after performing a main drain test, and c) develop a basis for the acceptance criteria of ≤ 25 psig and ≤ 10 psig that currently exists in the main drain test procedures.

LR-ISG-2012-02 AMP XI.M27 recommends that, as stated in NFPA Section 13.2.5.2, a 10 percent reduction on full flow pressure during main drain tests should be corrected. During the audit, the staff confirmed that the fire water system header pressure is 150 psig, plus or minus 10 psig. Although the enhancement states that the basis for the less than or equal to 25 psig and less than or equal to 10 psig criteria will be developed before the period of extended operation, the staff could not complete its review of the Fire Water System Program until it was provided the basis for the acceptance criteria. By letter dated December 17, 2014, the staff issued RAI B.1.19-4 requesting that the applicant provide the basis for the acceptance criteria of less than or equal to 25 psig and less than or equal to 10 psig that currently exists in the main drain test procedures.

In its response dated January 15, 2015, the applicant revised this enhancement to state the following: "[I]n accordance with NFPA Section 13.2.5.2 when there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be identified and corrected as necessary." The applicant deleted part (c) of this enhancement.

The staff finds the applicant's response and this enhancement acceptable because, as amended, it is consistent with NFPA Section 13.2.5.2 and the acceptance criteria of a 10 percent reduction in full flow is sufficient to detect potential flow blockage. The staff finds the deletion of part (c) of the enhancement acceptable because with adoption of the 10 percent criterion, a basis for the less than or equal to 25 psig and less than or equal to 10 psig that currently exists in the main drain test procedures is not necessary for the staff to evaluate this enhancement. The staff's concern described in RAI B.1.19-4 is resolved.

Enhancement 5. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to notify the fire protection engineer of test results and deficiencies identified or detected during testing. The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, although personnel qualifications are not addressed in LR-ISG-2012-02 AMP XI.M27, when it is implemented, it will ensure that the appropriate personnel evaluate test results and inspection deficiencies.

Enhancement 6. As amended by letters dated July 30, 2014, and January 15, 2015, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to "ensure piping and sprinklers are cleaned if obstructions are identified during internal inspections."

LR-ISG-2012-02 AMP XI.M27 recommends that, as stated in NFPA Section 5.2.1.1.2, sprinklers that are corroded or that exhibit loading should be replaced. By letter dated December 17, 2014, the staff issued RAI B.1.19-5 requesting that the applicant state the basis for why cleaning debris from a sprinkler will not impact its ability to perform its CLB intended function(s) during the period of extended operation.

In its response dated January 15, 2015, the applicant revised the enhancement to state that (a) piping is cleaned if obstructions are identified during inspections, (b) sprinklers are replaced if obstructions are identified during inspections, and (c) "[s]prinklers loaded with dust may be cleaned using air rather than replaced."

The staff finds the applicant's response and this enhancement acceptable because replacing sprinklers rather than cleaning them if obstructions are detected is consistent with LR-ISG-2012-02 AMP XI.M27 and NFPA 25 Section 5.2.1.1.2, which ensures that, rather than potentially damaging a sprinkler during cleaning, it is replaced. Use of compressed air to clean dust from a sprinkler is consistent with NFPA 25 Section A.5.2.1.1.2 (5), which recommends this practice for sprinklers loaded with a coating of dust. The staff's concern described in RAI B.1.19-5 is resolved.

Enhancement 7. As amended by letters dated July 30, 2014, and January 15, 2015, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. This enhancement reflects the changes to the "detection of aging effects" program element reflected in Enhancement 2 associated with the "parameters monitored or inspected" program element. The staff's evaluation of this enhancement is documented in the above discussion of Enhancement 2.

Enhancement 8. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to require that a "one-time internal inspection of the dry portion of the manual wet pipe system associated with the cable spreading room will be performed by removing a sprinkler toward the end of one branch line." As a result of the response to RAI B.1.19-1, this enhancement was deleted. The staff's evaluation of the RAI response is documented in Exception 7 above. Given the enhancement to the Periodic Surveillance and Preventive Maintenance Program described in Exception 7, the staff finds it acceptable to delete the one-time inspection of this piping because periodic inspections will be conducted.

Enhancement 9. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to:

> [P]erform at least once every five years either an internal inspection of the dry components downstream of the deluge valves for the hydrogen seal oil unit by removing a sprinkler toward the end of one branch line and inspecting for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinklers, or Revise Fire Water System Program procedures to perform at least once every five years an air or smoke test to verify there is no flow obstruction or blockage of sprinklers.

NFPA 25 Section 13.4.3.2.2.4 specifies that the interval between deluge valve full flow testing should not exceed 3 years. During the audit the staff confirmed that the applicant tests the hydrogen seal oil unit deluge system every 364 days.

The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when implemented, it will supplement the recommended deluge valve testing for the hydrogen seal oil unit, which is conducted more frequently than what is cited in NFPA 25.

Enhancement 10. As amended by letters dated July 30, 2014, and January 15, 2015, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to perform an internal inspection of the water distribution piping associated with charcoal filters, when the charcoal beds are replaced, for loss of material and debris that could result in flow blockage.

This enhancement is associated with Exception 7 above. The discussion of Exception 7 above documents the staff's evaluation of this enhancement.

Enhancement 11. As amended by letters dated July 30, 2014, and January 15, 2015, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to "perform an obstruction investigation after an extended shutdown of more than one year."

NFPA 25 Section 14.2.1.3 specifies that an obstruction investigation should be performed if sufficient inorganic material is found to obstruct pipe or sprinklers. In addition, NFPA 25 Section 14.3.1 includes criteria for conducting an obstruction inspection related to aging management (e.g., discharge of obstructive material during routine water tests, plugging of inspector's test connection, and pinhole leaks). During the audit, the staff did not find any procedures that included the additional criteria for conducting an obstruction investigation. In addition, the applicant did not provide a basis for why its enhancement is sufficient to ensure that it would conduct obstruction investigations when appropriate. By letter dated December 17, 2014, the staff issued RAI B.1.19-6 requesting that the applicant state the criteria that will be used to determine when an obstruction investigation should be conducted.

In its response dated January 15, 2015, the applicant revised the enhancement to state that obstruction investigations will be conducted whenever any of the criteria in NFPA 25 Sections 14.2.1.3 or 14.3.1 are met.

The staff finds the applicant's response and this enhancement acceptable because obstruction investigations will be conducted consistent with LR-ISG-2012-02 AMP XI.M27 and NFPA 25 Sections 14.2.1.3 or 14.3.1, which ensures that when conditions occur that could be indicative of potential flow blockage, the extent of the issue is investigated and corrected. The staff's concern described in RAI B.1.19-6 is resolved.

Enhancement 12. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that a walk down of normally dry piping that is periodically wetted will be conducted to determine whether there are any segments that collect water. The applicant also stated that it will conduct periodic inspections or tests of normally dry but periodically wetted firewater system piping that are collecting water, including flow test, flushes, or internal inspections of 100 percent of the piping that cannot be drained or allows water to collect, and will conduct volumetric wall thickness measurements of 20 percent of the piping. The flow tests, flushes, or internal inspections will commence 5 years before the period of extended operation and will be conducted every 5 years during the period of extended operation. The wall thickness measurements will be conducted every 5 years during the period of extended operation. The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when it is implemented, it will be consistent with LR-ISG-2012-02 AMP XI.M27, which recommends the described augmented tests and inspections for normally dry piping that is periodically wetted and allows water to collect.

Enhancement 13. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to "include acceptance criteria that any indication of fouling is evaluated."

The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when it is implemented, it will be consistent with LR-ISG-2012-02 AMP XI.M27, which recommends that indications of degradation detected during flow testing and visual inspections should be evaluated.

Enhancement 14. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to "specify that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and the source and extent of condition determined, corrected, and the condition entered into the Corrective Action Program." The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when it is implemented, it will be consistent with LR-ISG-2012-02 AMP XI.M27, which recommends removal of debris, evaluation of the debris source, and actions taken to correct the cause of the source of the debris.

Enhancement 15. As amended by letter dated July 30, 2014, LRA Section B.1.19 states an enhancement to the "corrective actions" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to "replace sprinklers associated with representative tested sprinkler, if the representative test sprinkler fails to meet the test requirements." The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-02 AMP XI.M27 and finds it acceptable because, when it is implemented, it will be consistent with LR-ISG-2012-02 AMP XI.M27, which recommends testing of sprinklers that have been in service for 50 years to determine whether they need to be replaced.

Enhancement 16. As amended by letter dated January 15, 2015, LRA Section B.1.19 states an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to state that any sprinkler that shows signs of corrosion will be replaced. RAI B.1.19-7 documents the staff's evaluation of this enhancement.

Enhancement 17. As amended by letters dated January 15, 2015, and April 10, 2015, LRA Section B.1.19 states an enhancement to the “corrective action” program element. In this enhancement, the applicant stated the following:

> If the decreasing trend in fire water system flow tests is not resolved through the Corrective Action Program prior to the period of extended operation, revise Fire Water System Program procedures to continue performing annual fire water system flow tests during the period of extended operation until such a time as trend data from fire water system flow tests indicates that the system will be capable of performing its intended function throughout the period of extended operation and therefore TRM frequency may be resumed.

RAI B.1.19-8 below documents the staff’s evaluation of this enhancement.

Enhancement 18. As amended by letter dated April 10, 2015, LRA Section B.1.19 states an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that the Fire Water System Program procedures will be revised to document the inspection of the drain down water from the steel piping upstream of the control center HVAC units. The response to RAI B.1.19-2a documents the staff’s evaluation of this enhancement.

Based on its audit and review of the applicant’s responses to RAIs B.1.19-1 through B.1.19-7 and RAI B.1.19-2a, the staff finds that program elements 1 through 6 and the “corrective actions” program element for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of LR-ISG-2012-02 AMP XI.M27. The staff also reviewed the exceptions associated with the “detection of aging effects” program element and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” “acceptance criteria,” 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.1.19 summarizes operating experience related to the Fire Water System Program. The LRA describes instances in which planned inspections were not conducted and describes inspections that identified internal tubercles.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

One of the plant-specific operating experience examples cited in the LRA describes fire suppression flow testing that demonstrated degrading conditions in the underground piping system. The applicant stated that it increased the frequency of testing and evaluation of this piping from 3 years, as required in the CLB, to annual testing. Based on its review of corrective action reports that describe the trend of degradation, it is not clear to the staff why the increased frequency of testing should not be continued during the period of extended operation. By letter dated December 17, 2014, the staff issued RAI B.1.19-8 requesting that the applicant state the basis for why performing the fire suppression flow test of the underground piping system every 3 years during the period of extended operation will be adequate to detect a decreasing trend before the system not being able to perform its CLB intended function.

In its response dated January 15, 2015, the applicant revised the Fire Water System Program to include a new enhancement, Enhancement 17, as described above.

The staff did not find the applicant’s response and Enhancement 17 acceptable because the enhancement states that the applicant will “consider in accordance with the Corrective Action Program increasing test frequency.” The term “consider” leaves it indeterminate whether the frequency of fire water system flow tests will be increased during the period of extended operation if the current decreasing trend in system performance reveals that the system may not be capable of performing its intended function throughout the period of extended operation. With the current trend in performance, the staff lacked sufficient information to conclude that existing corrective actions will be sufficient to correct the adverse trend; therefore, the staff could not conclude that the applicant has appropriately evaluated plant-specific operating experience. By letter dated March 11, 2015, the staff issued RAI B.1.19-8a requesting that the applicant state the basis for why the current trend in system performance will be corrected before the period of extended operation or state a commitment to continue the increased frequency of fire water system flow tests until such time as trend data demonstrate that the system will be capable of performing its intended function throughout the period of extended operation.

In it response dated April 10, 2015, the applicant stated annual flow tests will continue to be conducted until the data demonstrate that the fire water system will be capable of performing its intended function throughout the period of extended operation. The applicant revised LRA Sections A.1.19 and B.1.19 and Commitment No. 14 to reflect the revision to Enhancement 17.

The staff finds the applicant’s response and enhancement acceptable because annual flow testing provides sufficient input data to the plant staff to determine the extent of degraded conditions in the underground portions of the fire water system. The staff’s concern described in RAIs B.1.19-8 and B.1.19-8a is resolved.

Based on its audit and review of the application and review of the applicant’s response to RAIs B.1.19-8 and B.1.19-8a, 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 LR-ISG-2012-02 AMP XI.M27 was evaluated.

<u>UFSAR Supplement</u>. LRA Section A.1.19, as amended by letters dated July 30, 2014; January 15, 2015; and April 10, 2015, provides the UFSAR supplement for the Fire Water System Program.

The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02, and noted that as amended by letter dated July 30, 2014, LRA Section A.1.19 references fouling and flow blockage. However, these statements only refer to conducting visual inspections, not all of the inspections and testing in the program.

LR-ISG-2012-02 Table 3.0-1 recommends that the UFSAR supplement summary description for the Fire Water System Program should state that it manages fouling and flow blockage. The CLB for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information in its UFSAR supplement. By letter dated December 17, 2014, the staff issued RAI B.1.19-9 requesting that the applicant state the basis for not including fouling and flow blockage in the UFSAR supplement description for the Fire Water System Program.

In its response dated January 15, 2015, the applicant revised LRA Section A.1.19 to state the program "manages loss of material due to general pitting, and crevice corrosion, microbiologically-influenced corrosion, or fouling, and flow blockage due to fouling." Therefore, the UFSAR supplement for the Fire Water System Program is consistent with the corresponding program description in LR-ISG-2012-02 SRP-LR Table 3.0-1. The staff's concern described in RAI B.1.19-9 is resolved.

The staff also noted that the applicant committed to enhance the program as described in the above Enhancements 1 through 18. The staff further noted that the applicant committed to implement the enhancement(s) "[p]rior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later, with the exception that the activities described in this commitment for piping segments designed to be dry but determined to be collecting water shall be conducted within five years prior to March 20, 2025."

The staff finds that the information in the UFSAR supplement, as amended by letter dated April 10, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Fire Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exception(s), is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Flow-Accelerated Corrosion

Summary of Technical Information in the Application. LRA Section B.1.20 describes the existing Flow-Accelerated Corrosion Program as consistent, with enhancements, with GALL Report AMP XI.M17, "Flow-Accelerated Corrosion." The LRA states that the program manages wall thinning caused by flow-accelerated corrosion in carbon steel piping and components by performing an analysis to identify susceptible systems, conducting analyses to predict wall thinning, performing wall thickness measurements based on predictions and operating experience, and evaluating measurement results to determine the remaining service life and the need for replacement or repair. The LRA also states that the program relies on implementing the guidelines of EPRI NSAC-202L-R3, "Recommendations for an Effective Flow-Accelerated Corrosion Program," Revision 3, dated August 10, 2007, and internal and external operating experience. In addition, the LRA states that the program also manages wall thinning due to various erosion mechanisms in treated water or steam systems for all materials that may be identified through industry or 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. For the "scope of program" program element, the staff identified 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.M17 recommends that the program, as described by EPRI NSAC-202L, includes procedures or administrative controls to ensure that the structural integrity is maintained. The applicant's program uses the CHECWORKS™ predictive software and categorizes this software as Class B. The staff noted that the applicant's administrative controls only allow software categorized as Class A to be used for safety-related design work; however, the implementing procedures allow the wear calculated using CHECWORKS™ to demonstrate that the design wall thickness will be met at the next RFO. The staff also noted that the program includes both safety-related and nonsafety-related components, but does not limit the use of the wear rates calculated by CHECWORKS™ to nonsafety-related components. By letter dated December 19, 2014, the staff issued RAI B.1.20-1 requesting that the applicant demonstrate how wear rates calculated by CHECWORKS™ for safety-related components are independently checked and verified or justify the use of Class B software for safety-related design work.

In its response dated January 28, 2015, the applicant stated that it had revised the implementing procedure (MES26, "Flow-Accelerated Corrosion, Prediction, Detection, and Correction") in December 2014 to modify the process for component evaluation. The applicant stated that MES26 now draws a distinction between ANSI B31.1, "Power Piping," (nonsafety-related) and ASME Code Section III (safety-related) components requiring ASME Code components to be evaluated using methods that do not use CHECWORKS™ calculation results and that allow for independent verification by a qualified checker. The applicant also stated that MES26 includes a new enclosure listing all lines containing ASME Code components to ensure the appropriate methodology is used for analysis. The staff finds the applicant's response acceptable because the applicant revised its implementing procedure to distinguish between safety-related and nonsafety-related components to ensure that calculation results from CHECWORKS™, which is currently categorized as Class B software, are not used for safety-related design work. The staff's concerns described in RAI B.1.20-1 are resolved.

According to SRP-LR Section A.1.2.3.1, the "scope of program" program element should include the specific SCs that are being managed by the program. The staff noted that the onsite information identified Program Notebook PEP19, "Flow-Accelerated Corrosion," as one of the sources of information for this program. Although PEP19 specifies the "Feedwater Heater Susceptibility Review" as one of the items to be considered for the outage scope, the staff noted that LRA Table 3.4.2-2 only showed the feedwater shells as being managed for loss of material by the Water Chemistry Control – BWR Program. By letter dated December 19, 2014, the staff issued RAI B.1.20-2 requesting that the applicant clarify whether the feedwater shells are being managed for loss of material by the Flow-Accelerated Corrosion Program.

In its response dated January 28, 2015, the applicant stated that the Flow-Accelerated Corrosion Program manages loss of material in the feedwater heater shells through periodic inspections. The applicant also revised LRA Table 3.4.2-2 by adding a new item that includes the Flow-Accelerated Corrosion Program for managing loss of material in the feedwater heat exchanger shells. The staff finds the applicant's response acceptable because the applicant revised LRA Table 3.4.2-2 to include the specific components being managed by the program as recommended in the SRP-LR. The staff's concern described in RAI B.1.20-2 is resolved.

The staff also reviewed the portions of the "scope of program," "detection of aging effects," "monitoring and trending," and "corrective action" 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.1.20 includes an enhancement to the "scope of program," "detection of aging effects," "monitoring and trending," and "corrective action" program elements. In this enhancement, the applicant stated that the program procedures would be revised to indicate that the Flow-Accelerated Corrosion Program also manages loss of material due to erosion mechanisms and to include a susceptibility review based on internal and external operating experience and various industry guidance documents. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M17, as modified by LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms," dated May 1, 2013, and notes that the LRA currently contains several of the new AMR items included in LR-ISG-2012-01. The staff finds the enhancement acceptable because, when it is implemented, the Flow-Accelerated Corrosion Program will manage loss of material due to erosion mechanisms consistent with the guidance provided in LR-ISG-2012-01.

Enhancement 2. LRA Section B.1.20 includes an additional enhancement to the "corrective action" program element. In this enhancement, the applicant stated that the program procedures would be revised to specify that downstream components are monitored for wall thinning whenever susceptible upstream components are replaced with materials that are resistant to flow-accelerated corrosion. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M17 and finds it acceptable because monitoring the wear rates on components downstream of components that are replaced with resistant materials is appropriate based on industry guidance and because it is consistent with the guidance in the GALL Report.

Based on its audit and review of the applicant's responses to RAIs B.1.20-1 and B.1.20-2, 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. In addition, the staff reviewed the enhancements associated with the "scope of program," "detection of aging effects," "monitoring and trending," 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.1.20 summarizes operating experience related to the Flow-Accelerated Corrosion Program. The LRA discusses self-assessments and gap studies performed in 2008, 2010, and 2011 that resulted in recommendations, gaps, and deficiencies being entered into the applicant's corrective action program. The LRA also includes examples of specific inspections that resulted in replacements or increased inspection frequencies. The LRA concludes that the history of identification of degradation and program deficiencies with subsequent corrective actions before loss of intended function provide assurance that the program will remain effective.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M17 was evaluated.

UFSAR Supplement. LRA Section A.1.20 provides the UFSAR supplement for the Flow-Accelerated Corrosion Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the UFSAR supplement included a description of the program enhancements discussed above that are also contained in Commitment No. 15. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Flow-Accelerated Corrosion Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Inservice Inspection – IWF

Summary of Technical Information in the Application. LRA Section B.1.22 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 addresses ASME Code Class 1, 2, 3 and metal containment (MC) piping supports and component supports exposed to uncontrolled indoor air, outdoor air, and fluid to manage the effects of loss of material, loss of mechanical function, and loss of preload. The LRA also states that the AMP proposes to manage these aging effects through periodic visual inspections. The LRA further states that the AMP is implemented through plant procedures and that the necessary activities are conducted to comply with the requirements of ASME Code Section XI in accordance with 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.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 an RAI, as discussed below.

The “detection of aging effects” program element in GALL Report AMP XI.S3 recommends that, for high strength structural bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in nominal diameter, volumetric examinations should be performed in addition to VT-3 (i.e., visual examinations) to detect cracking. GALL Report AMP XI.S3 also has the following recommendations for aging management of high strength structural bolting:

- The “scope of program” program element states that the scope of the program includes high strength structural bolting.
- The “preventive actions” program element recommends using bolting material that has an actual measured yield strength that is less than 150 ksi.
- The “parameters monitored or inspected” program element recommends that high strength structural bolting susceptible to SCC should be monitored for cracking.
- The “detection of aging effects” program element states that the volumetric examination may be waived with adequate plant-specific justification.

The staff noted that the AMP includes enhancements to revise plant procedures to identify unacceptable conditions, such as “cracked or sheared bolts, including high strength bolts.” However, it is not clear whether there are high strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in nominal diameter within the scope of the AMP. In addition, it is not clear how the applicant plans to manage aging for these components consistent with GALL Report AMP XI.S3 recommendations in the “preventive actions” and “parameters monitored or inspected” program elements described above. The LRA also states that “[p]lant procedures prohibit the use of lubricants containing molybdenum disulfide [(MoS2)]. Since the use of this type of lubricant is prohibited in plant procedures and plant procedures provide the technical guidance for installation requirements [...], the potential for [SCC] for high-strength structural bolting material, i.e., ASTM A325 and A490, is not plausible.” Because the use of MoS_2 is not the only contributor to SCC of high strength bolts, the staff has not determined that there is sufficient basis to conclude that SCC is not a credible aging effect for high strength structural bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in diameter. If there are high strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in diameter within the scope of license renewal, the staff needs additional information regarding the environments to which these bolts are exposed to evaluate the applicant's claim that there is no potential for SCC. Therefore, by letter dated December 19, 2014, the staff issued RAI B.1.22-1 requesting the applicant to:

(1) State whether or not there are high-strength structural bolts (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, and

(2) If high strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch diameter are within the scope of the AMP, (a) provide additional information regarding the environments to which bolts are exposed, and (b) state whether the recommendations for managing degradation of high-strength bolts described in the “preventive actions” and “parameters monitored or

inspected" of GALL Report AMP XI.S3 will be implemented for the Inservice Inspection – IWF Program.

By letter dated February 19, 2015, the applicant provided its response to RAI B.1.22-1. In its response to RAI B.1.22-1, Part (1), the applicant stated that it reviewed the Fermi 2 pipe erection specification, concrete anchor specification, and 100 percent of the hanger sketch bill of materials for the ASME Code Section XI Class 1, 2, 3 component supports that are part of the ISI sample. Based on its review of these documents, the applicant determined that there are 60 ASTM A490 high strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in diameter within the scope of the Inservice Inspection – IWF Program. The bolts are located in the RPV skirt to ring girder bolted joint and are subject to visual inspections under the Inservice Inspection – IWF Program. The applicant also stated that there are no additional high strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in diameter within the scope of the Inservice Inspection – IWF Program. In its response to RAI B.1.22-1, Part (2)(a), the applicant stated that the bolts are "installed in the lower area of the bioshield annulus, which is a dry and relatively cool area of the drywell" and that the bolt thread lubricant does not contain MoS_2. The applicant also stated that, during Fermi 2 plant operation, the drywell is inerted with nitrogen. Based on these conditions the applicant concluded that the bolts are in a noncorrosive low-temperature environment; therefore, the initiation of SCC is not a credible aging effect. In its response to RAI B.1.22 1, Part (2)(b), the applicant stated that the recommendations for high strength bolts stated in the "preventive actions" program element of GALL Report AMP XI.S3 will be implemented through an enhancement in LRA Section B.1.22. The applicant also stated that the recommendations in GALL Report AMP XI.S3 "parameters monitored or inspected" program element regarding monitoring for cracking of high strength bolts susceptible to SCC through volumetric inspection do not apply to Fermi 2 because the high strength bolts at Fermi 2 are not in a corrosive environment and, therefore, are not susceptible to SCC.

The staff finds the applicant response to RAI B.1.22-1, Part (1), acceptable because the applicant completed a review of applicable drawings and specifications regarding ASME Code Section XI Class 1, 2, 3 component supports and clarified that there are high strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch in diameter within the scope of the Inservice Inspection – IWF Program. The staff finds the applicant response to RAI B.1.22-1, Part (2)(a), acceptable because the applicant clarified that the high strength bolts are exposed to a dry, noncorrosive, and inert environment. The staff needed additional clarification of the response to RAI Part (2)(b). Although the applicant states that it will implement the recommendations in the "preventive actions" program element to use bolting material with an actual yield strength less than 150 ksi, the applicant did not include this information in the LRA. In addition, the staff needed clarification regarding whether the applicant inspects the drywell bioshield annulus area so that it can verify that the environment is kept dry. Therefore, during a telephone conference call held on March 6, 2015, the staff asked the applicant for clarification on these concerns. During the call, the applicant stated that it would provide information on bolting selection in the LRA. The applicant also stated that the drywell bioshield annulus area is inspected every RFO.

By letter dated April 17, 2015, the applicant submitted a supplemental response to RAI B.1.22-1, Part (2)(b). In its supplemental response, the applicant revised LRA Sections A.1.22 and B.1.22 and Table A.4 (Commitment No. 16) to include an enhancement to the Inservice Inspection – IWF Program to "revise plant procedures to include the preventive action of using bolting material that has an actual measured yield strength less than 150 ksi, except in the case of like-for-like replacement of existing bolting material in the reactor pressure vessel skirt to ring girder bolted joint."

The staff reviewed the applicant's response to RAI B.1.22-1, Part (2)(b), and noted that GALL Report AMP XI.S3 recommends that the industry recommendations delineated in EPRI NP-5769 be implemented in the Inservice Inspection – IWF Program for high strength structural bolting. The GALL Report and EPRI NP-5769 state that SCC is caused by an undesirable combination of susceptible material, significant stress, and an aggressive environment. The staff notes that an aggressive environment that can contribute to SCC is described as one consisting of a wet environment with high levels of dissolved oxygen and/or aggressive contaminants, such as chlorides and sulfates (e.g., MoS_2). The GALL Report; EPRI NP-5769; and GL 91-17, "Generic Safety Issue 29, 'Bolting Degradation or Failure in Nuclear Power Plants,'" dated October 17, 1991, also states that MoS_2 is a potential contributor to SCC, especially when applied to high strength bolting steels and, therefore, should not be used. The staff notes that inert nitrogen is used to displace and maintain low levels of oxygen concentrations in the drywell atmosphere. The staff also notes that the applicant inspects the drywell bioshield annulus area every RFO. The staff confirmed, based on its review of Fermi 2's 2009 ISI Summary Report (ADAMS Accession No. ML092100486), that 100 percent of the support bolts are visually inspected (VT-3) every 10 years as required in accordance with Table IWF 2500-1 for Class 1 supports (supports other than piping supports). Therefore, the staff finds the applicant's response to RAI B.1.22-1, Part (2)(b), acceptable for the following reasons:

- The high strength structural bolts in the RPV skirt to ring girder bolted joint are not exposed to an aggressive environment (i.e., wet environment with high levels of oxygen concentration and/or use of MoS_2 as a lubricant) conducive of SCC; therefore, this is an adequate justification to waive the GALL Report-recommended volumetric examinations to detect cracking due to SCC in high strength structural bolts.
- The applicant revised the LRA to include an enhancement to follow GALL Report AMP XI.S3 recommendations in the "preventive actions" program element to only procure high strength structural bolts that have an actual measured yield strength that is less than 150 ksi when bolts are to be installed elsewhere than the RPV skirt to ring girder bolted joint.
- The inspection of the drywell bioshield annulus area performed every RFO and the required ASME Code IWF visual (VT-3) inspection of 100 percent of the support bolts performed every 10 years provide reasonable assurance that the applicant will identify conditions that may be conducive of SCC and will take corrective actions before there is a loss of intended function.

The staff's concerns described in RAI B.1.22-1 are resolved.

The staff also reviewed the portions of the "preventive actions," "detection of aging effects," "monitoring and trending," 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.1.22 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, such as proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolts, as recommended in NUREG-1339, EPRI NP-5769, EPRI NP-5067, and EPRI TR-104213. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will make the program consistent with the recommendations in the GALL Report to use the guidelines in EPRI documents and NUREG-1339 for selection of material, installation of bolts, and use of lubricants to prevent or mitigate degradation or failure of bolting.

Enhancement 2. LRA Section B.1.22 includes an enhancement to the "preventive actions," program element. In this enhancement, the applicant stated that plant procedures will be revised to require that maintenance activities and replacement of structural bolting include appropriate preload and torque consistent with the recommendations in EPRI documents, ASTM standards, and American Institute of Steel Construction (AISC) specifications. Plant procedures will also be revised to include the preventive actions in Section 2 of the RCSC report "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for the storage of ASTM A325 and A490 bolting. By letter dated April 17, 2015, the applicant revised this enhancement "to include the preventive action of using bolting material that has an actual measured yield strength less than 150 ksi, except in the case of like-for-like replacement of existing bolting material in the [RPV] skirt to ring girder bolted joint." The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S3 and finds it acceptable (1) because, when it is implemented it, will make the program consistent with the recommendations in the GALL Report to use the guidelines in referenced EPRI documents; ASTM standards; AISC specifications; and Section 2 of the RCSC report, as applicable, for the proper preload, tightening, and storage of structural bolting, and (2) because, as discussed above in the staff's evaluation of RAI B.1.22-1, once every 10 years visual examinations of 100 percent of the high strength bolts located in the RPV skirt to ring girder bolted joint are adequate to manage the applicable aging effects because these bolts are not exposed to an aggressive environment that may be conducive of SCC.

Enhancement 3. LRA Section B.1.22 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that plant procedures will be revised to include detection of aging effects, such as loss of material of anchor bolts, loose or missing nuts and bolts, and cracking of concrete around 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, it will make the program consistent with the recommendations in the GALL Report to monitor structural bolts for loss of material and loose or missing nuts and to monitor concrete around anchor bolts for cracking.

Enhancement 4. LRA Section B.1.22 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that plant procedures will be revised to identify unacceptable conditions such as debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces, as intended in the design basis of the support, and 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, it will make the program consistent with the recommendations in the GALL Report to include in the acceptance criteria unacceptable conditions of supports that may result in a component not meeting its design basis.

Enhancement 5. LRA Section B.1.22 as revised by letter dated April 27, 2014, includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that plant procedures will be revised to "include assessment of the impact on the inspection sample, in terms of sample size and representativeness, if components that are part of the sample population are reworked." The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will ensure that the IWF sample population is representative of the age-related degradation of the total population of supports and component supports within the scope of the Inservice Inspection – IWF Program.

Based on its audit and review of the applicant's response to RAI B.1.22-1, 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," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.22 summarizes operating experience related to the Inservice Inspection – IWF Program.

In 2010, the applicant inspected 34 supports consistent with its NDE program. The inspection identified a discrepancy in the gap between the pipe and the pipe support box of one pipe support. The applicant entered the issue into the corrective action program, and the issue was resolved.

In 2012, the applicant inspected 40 supports. As a result of the inspection, only one corrective action report was written regarding rust and water at one of four torus earthquake ties. The applicant also inspected 19 main steam constant support hangers in the steam tunnel. The applicant stated that "although wear was observed, all supports were found acceptable based on evaluation." The applicant performed a minor repair on one support.

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 also determined that the operating experience provided by the applicant is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is adequate to detect and manage the effects of aging. During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of RAIs, as discussed below.

GALL Report AMP XI.S3 states that MoS_2 should not be used as a lubricant due to its potential contribution to SCC, especially for high strength bolts (actual yield strength greater than or equal to 150 ksi). During its onsite audit, the staff reviewed the AMP basis documents and 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 Fermi 2 before plant procedures were revised to prohibit their use. By letter dated December 19, 2014, the staff issued RAI B.1.2-3, 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 in nominal diameter within the scope of license renewal. The staff evaluation of the applicant response is documented in SER Section 3.0.3.2.1. Based on the applicant's response to RAI B.1.2-3, the staff concluded that the applicant did not prescribe the use of MoS_2 lubricants at Fermi 2; therefore, there is reasonable assurance that the adverse degradation effects (e.g., SCC) in high strength bolts that can be caused by the use of MoS_2 lubricants will not be present at Fermi 2. The staff's concern in RAI B.1.2-3 is resolved.

The GALL Report AMP XI.S3 "monitoring and trending" program element states that examinations of Class 1, 2, 3 and MC component supports and related hardware that reveal unacceptable conditions that exceed the acceptance criteria and that require corrective measures are extended to include additional examinations in accordance with ASME Code Section XI, Subsection IWF-2430. The ASME Code Section XI, Subsection IWF-2430, 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. The staff noted that there is recent industry operating experience in which degraded conditions were found during ASME Code Section XI, Subsection IWF-2430, examinations of Class 1, 2, 3 and MC component supports and related hardware and an engineering evaluation determined that the as-found component/hardware was acceptable as is, but the component/hardware was still reworked to the as-new condition. Because it was determined that the as-found condition did not affect the support's capability to perform its design function or exceed the threshold of ASME Code Subsection IWF-3400 acceptance criteria, the licensee did not apply ASME Code Subsections IWF-2420 and IWF-2430 for successive or additional examinations. The staff is concern that if ASME Code Section XI, Subsection IWF, supports that are part of the inspection sample are reworked to as-new condition, they may no longer be representative of the other supports in the population; therefore, subsequent inspections of the same sample would not represent the age-related degradation of the rest of the population. The staff noted that the LRA and associated AMP basis documents provide no discussion of how this issue would be addressed or any indication on whether the IWF sample would be changed or expanded if a support within the original sample was reworked. By letter dated December 19, 2014, the staff issued RAI B.1.22-2 requesting that the applicant describe, when corrective actions are not required per the ASME Code Subsection IWF acceptance criteria but when a component in the IWF sample is reworked and no longer represents age-related degradation of the entire population, how the AMP will be effective in managing aging of similar/adjacent components that are not included in the IWF inspection sample.

In its response dated January 20, 2015, the applicant stated that its IWF component support inspection is consistent with the sample percentages specified in the ASME Code Section XI and includes more than 250 supports being examined each 10-year interval. Procedures require that discrepancies be reported in the corrective action program and that a CARD should be made to initiate a work order for maintenance. The applicant stated that correction of some conditions over the life of the plant will not impair the ability of the Inservice Inspection – IWF Program to manage the effects of aging and that modifying the program to add new component locations when a condition has been addressed is not necessary because (1) the degradation will likely be caused by local environmental or operational conditions (e.g., vibration or humidity), (2) the program requirements for sample expansion or extent of condition will address the degradation, and (3) the IWF inspection sample size is "large enough that correction of some conditions will not prevent the program from adequately managing the effects of aging."

The staff reviewed the applicant response and notes that the basis for not considering modification of the program to add new components to the population sample is acceptable if, after rework of the component, the sample continues to represent all combinations of material, environments, operational conditions, and leading indicators of degradation of the population. The staff determined that consideration needs to be taken as to whether reworking of a sample component that meets the IWF acceptance may result in that component no longer representing the degradation of the population. The staff noted that, after a component is reworked, the material, environment, and degradation conditions could result in the component no longer representing the degradation of the population independently of the sample size. The staff needed additional information because it was not clear whether, in the absence of the requirements of sample expansion or extent of condition when a reworked sample component meets the IWF acceptance criteria, the AMP will be effective in managing the aging effects of components that are similar/adjacent to the reworked component but that are not included in the IWF inspection sample. Therefore, by letter dated March 26, 2015, the staff issued followup RAI B.1.22-2a requesting that the applicant state how the Inservice Inspection – IWF Program will ensure that the inspection sample will adequately represent the age-related degradation of the IWF component population when components that are part of the sample are reworked and no longer represent the age-related degradation of the remaining population.

In its response dated April 27, 2015, the applicant stated that "[t]he Inservice Inspection [–] IWF Program will be enhanced to include assessment of the impact on the inspection sample, in terms of sample size and representativeness, if components that are part of the sample population are re-worked." The staff noted that, as part of its response, the applicant revised LRA Sections A.1.22 and B.1.22 and Table A.4 Commitment No. 16 to include this enhancement to the Inservice Inspection – IWF Program.

The staff finds this response acceptable because the applicant's enhancement to the Inservice Inspection – IWF to include an assessment on the representativeness of the inspection sample when a sample component is reworked provides reasonable assurance that the inspection sample will represent the age-related degradation of the total population of IWF supports and component supports. The staff's concern described in RAIs B.1.22-2 and B.1.22-2a is resolved.

Based on its audit and review of the application and review of the applicant's responses to RAIs B.1.22-2 and B.1.22-2a, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S3 was evaluated.

UFSAR Supplement. LRA Section A.1.22 provides the UFSAR supplement for the Inservice Inspection – IWF Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before September 20, 2024. The staff finds that the information in the UFSAR supplement, as amended by letter dated April 27, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Inservice Inspection – IWF Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Summary of Technical Information in the Application. LRA Section B.1.23 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 inspections through plant procedures and PM and manages loss of material due to corrosion, loose bolting or rivets, and crane rail wear of cranes and hoists within the scope of 10 CFR 54.4. The LRA also states that visual examinations and functional testing on active crane components, not credited for managing relevant passive components, ensure that cranes and hoists are capable of maintaining their intended function through the period of extended operation. The LRA further states that the program evaluates the effectiveness of the maintenance monitoring program and the effects of usage on the reliability of the cranes and hoists.

The LRA states that the scope of program includes structural bolting for the bridge, trolley, lifting devices, and rails in the rail system and includes cranes and hoists that meet the provisions of 10 CFR 54.4 (a)(1) and (a)(2), as well as that of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Technical Activity A-36." The LRA also states that the program will be enhanced to implement the guidance provided in ASME Code Safety Standard B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)," dated 2005.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M23.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "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.1.23 includes an enhancement to the "scope of program" and "parameters monitored or inspected" program elements. 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/bolting for loose or missing bolts, nuts, pins or rivets and any other conditions indicative of loss of bolting integrity. The "scope of program" program element of GALL Report AMP XI.M23 recommends that the program manages loss of material due to general corrosion of bridge rails, bridge, and trolley structural components; wear on the rails; and loss of preload of bolted connections for all relevant components for cranes within the scope of 10 CFR 54.4. The "parameters monitored or inspected" program element of GALL Report AMP XI.M23 recommends the use of visual inspections to monitor surface conditions to ensure 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 elements in GALL Report AMP XI.M23 and finds it acceptable because, when it is implemented, it will align the "scope of program" program element with that of the GALL Report AMP to manage the effects of aging for crane rails, bridge trolley, and hoists for loss of material due to general corrosion and wear, and bolts for loss of bolting integrity and preload. The enhancement will also make the "parameters monitored or inspected" program element consistent with the GALL Report AMP recommendation to monitor loss of material due to corrosion; wear; loose bolts and nuts; missing nuts, pins, and rivets; 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 deformation is an aging mechanism that could lead to age-related degradation. The inclusion of these additional parameters monitored to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program provides additional assurance that age-related degradation would be identified before the loss of intended function of the included components.

Enhancement 2. LRA Section B.1.23 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it plans to "revise plant procedures to specify inspection frequency requirements in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series." GALL Report AMP XI.M23 recommends that visual inspections be conducted at a frequency consistent with ASME Code Safety Standard B30.2 or another appropriate ASME Code Safety Standard 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, the program will follow the inspection frequency recommendations in accordance with ASME Code Safety Standard B30.2, which provides guidance regarding timely periodic inspections of infrequently used cranes and their systems and components (e.g., rails, structural components, bolts, and nuts), or will use another applicable ASME Code Safety Standard B30, which is consistent with the recommendations in the GALL Report AMP.

Enhancement 3. LRA Section B.1.23 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 Code Safety Standard B30.2 or other appropriate safety standard in the ASME Code Safety Standard B30 series. The staff noted that the GALL Report considers an aging mechanism to be significant when it could potentially result in aging effects that produce a loss of intended function of a component or structure if allowed to continue without mitigation. The staff also noted that GALL Report AMP XI.M23 recommends that any visual indication of loss of material due to corrosion or wear and loss of bolting preload should be evaluated in accordance with ASME Code Safety Standard B30.2 or other applicable ASME Code Safety Standard 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 loss of material due to wear in crane rails and loss of preload in bolted connections are inspected and evaluated in accordance with applicable ASME Code Safety Standard B30 series and as recommended by Chapter 2-4, "Maintenance Training and Maintenance," of the ASME Code Safety Standard B30.2, which states that any condition disclosed by the inspections performed in accordance with the standard that is determined to be a hazard to continued operation shall be corrected by adjustment, repair, or replacement before continuing the use of the crane.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M23. In addition, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," "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.1.23 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 two examples addressed in the LRA described below.

In 2005, following the April 24, 2004, DTE Electric Monroe Power Plant hoist failure, a review of site cranes and hoists and maintenance procedures resulted in the enhancement of the procedures to address inspection provisions of codes and standards and vendor manuals and the inclusion of additional inspections. The LRA also states that a 2009 NRC inspection of cranes and heavy lifting, performed in accordance with the supplemental guidance to the NRC Inspection Procedure 71111.20, "Refueling and Other Outage Activities," and as part of an operating experience smart sample program, did not yield any issues that needed to be addressed. In addition to the above two examples, the staff also noted, during its onsite audit operating experience review, a 2009 condition assessment of a bolted connection failure. The assessment indicated that a bolt failure occurred due to possible misalignment of turbine crane structural support members. Following an evaluation and identification of the root cause of the bolt failure to be fatigue, the bolt was replaced and repairs were performed eliminating any potential future crane loading 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. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M23 was evaluated.

UFSAR Supplement. LRA Section A.1.23 provides the UFSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before September 20, 2024. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the 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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 Masonry Wall

Summary of Technical Information in the Application. LRA Section B.1.25 describes the existing Masonry Wall Program as consistent, with enhancements, with GALL Report AMP XI.S5, “Masonry Walls.” The LRA states that the program manages the aging effects for loss of material and cracking of masonry walls such that applicable components will continue to perform their intended functions in accordance with 10 CFR 54.4, and consistent with the CLB through the period of extended operation. Included components are masonry walls required by 10 CFR 50.48, “Fire Protection”; radiation-shielding masonry walls; and masonry walls with the potential to affect safety-related components. The LRA also states that the program is based on the guidance provided in IE Bulletin 80-11, “Masonry Wall Design,” dated May 8, 1980, and NRC IN 87-67, “Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11,” dated December 31, 1987.

The LRA states the Masonry Walls Program is implemented as part of the Structures Monitoring Program (LRA Section B.1.42), which proposes to manage these aging effects through periodic visual inspections of masonry walls at a frequency of at least once every 5 years, with provisions for more frequent inspections to ensure there is no loss of intended function between inspections.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant’s program to the corresponding program elements of GALL Report AMP XI.S5.

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.S5 recommends that further evaluation is conducted if the extent of cracking and loss of material is sufficient to impact the intended function of the wall or to invalidate its evaluation basis. However, during its audit, the staff found that the applicant’s Masonry Wall Program appears not to address the “invalidate its evaluation basis” aspect of the acceptance criteria because Section 4 of the applicant’s referenced MMR14 procedure, “Fermi 2 Maintenance Rule Conduct Manual – Structures Monitoring,” describes the qualitative criteria for evaluation of inspections results in terms of structural functionality only. By letter dated November, 25 2014, the staff issued RAI B.1.25-1 requesting that the applicant clarify how the acceptance criteria for the inspection of masonry walls is consistent with that described in GALL Report AMP XI.S5 and provide either a supporting program enhancement if it is needed for consistency with the GALL Report or a description of the exception that includes the acceptance criteria and technical basis if different criteria from the GALL Report are being used.

In its response dated December 26, 2014, the applicant stated that an enhancement to the Masonry Wall Program (LRA Sections A.1.25 and B.1.25) is added to the Structures Monitoring Program (LRA Sections A.1.42 and B.1.42) to address the “invalidate evaluation basis” aspect and to clarify the “acceptance criteria” for the program described in LRA Section B.1.25, “Masonry Wall Program.”

The staff finds the applicant’s response acceptable because the enhancement provided by the applicant to address the “invalidate evaluation basis” aspect ensures that observed conditions do not invalidate the evaluation basis or impact the intended function of the applicant’s masonry walls as recommended in the “acceptance criteria” program element of GALL Report AMP XI.S5. The staff’s evaluation of this enhancement is documented in SER Section 3.0.3.2.22, “Structures Monitoring.” The staff’s concern described in RAI B.1.25-1 is resolved.

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 notes that the LRA Masonry Wall Program is implemented as part of the Structures Monitoring Program and that the LRA has integrated the enhancements for the Masonry Wall Program with the enhancements to the Structures Monitoring Program. Therefore, SER Section 3.0.3.2.22 documents the staff’s evaluation of LRA Section B.1.42 enhancements associated with masonry walls.

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 the program,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements relevant to the Masonry Wall Program, as integrated with the enhancements of the Structures Monitoring Program, and finds that, when they are implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.25 summarizes operating experience related to the Masonry Wall Program. A summary of the operating experience is given below:

In 2007, Fermi 2 personnel identify loose grout in a block wall in the turbine building basement during maintenance rule structural walkdowns. According to the LRA, the condition identified was entered into Fermi 2’s corrective action program and the identified condition was repaired.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S5 was evaluated.

UFSAR Supplement. LRA Section A.1.25 provides the UFSAR supplement for the Masonry Wall Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also notes that the applicant committed to implement the enhancements to the program as part of the Structures Monitoring Program (LRA Section A.1.42) before September 20, 2024.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Masonry Wall Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Neutron-Absorbing Material Monitoring

Summary of Technical Information in the Application. LRA Section B.1.27 describes the existing Neutron-Absorbing Material Monitoring Program as consistent, with enhancements, with GALL Report AMP XI.M40, "Monitoring of Neutron Absorbing Materials Other Than Boraflex." The LRA states that the AMP detects degradation of the neutron-absorbing material (i.e., Boral) used in spent fuel pools. The AMP relies on periodic inspection, testing, and other monitoring activities to ensure that the required 5-percent subcriticality margin is maintained during the period of extended operation. The LRA states that the AMP monitors loss of material and changes in dimension, such as blisters, pits, and bulges that could result in a loss of neutron-absorbing capability. The LRA further states that the frequency of testing will be based on the condition of the neutron-absorbing material at a minimum of once every 10 years in the period of extended operation.

In a letter dated September 24, 2015, the applicant provided supplemental information revising LRA Sections A.1.27 and B.1.27 to cover all neutron-absorbing material other than Boraflex (i.e., including, but not limited to, Boral) for the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M40.

The staff also reviewed the portions of the "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.1.27 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that, before the period of extended operation, it will revise the AMP procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every 10 years based on the condition of the neutron-absorbing material. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M40 and finds it acceptable because the GALL Report recommends establishing a frequency of inspection and testing, based on the condition of the neutron-absorbing material and determined and justified with plant-specific operating experience, not to exceed 10 years. The staff finds that when this enhancement is implemented it will make the AMP consistent with the recommendations of GALL Report AMP XI.M40.

Enhancement 2. LRA Section B.1.27 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that it will revise the AMP procedures to perform trending of coupon testing results to determine the rate of degradation. The LRA notes that this enhancement will ensure that the predicted boron-10 areal density will be sufficient to maintain the 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 the GALL Report recommends comparing periodic inspections to baseline information or prior measurements and analysis for trend analysis. The staff finds that when this enhancement is implemented it will make the AMP consistent with the recommendations of 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 enhancements associated with the "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.1.27 summarizes operating experience related to the Neutron-Absorbing Material Monitoring Program. The applicant provided the following operating experience:

In 2010, the LRA states that a Boral test coupon was found with numerous blisters (18 on the front side and 16 on the back side). The LRA states that one of the blisters on the front was 2.1 inches in diameter. The applicant evaluated the blisters and determined that they did not affect the neutron-absorbing properties of the Boral. The applicant revised the inspection procedure to require a blister characterization if blisters are observed on a Boral coupon and to require an inspection of the associated Boral capsule for any deformation that would be caused by blisters.

In 2010, the applicant made enhancements to its procedure regarding Boral coupon surveillance. The enhancements were based on operating experience presented at an EPRI Neutron Absorber User Group meeting.

In 2013, the applicant performed a Boral coupon test at Pennsylvania State University. The applicant performed an NDE on coupon YD610122-1-7. The coupon was determined to be in good overall condition with several very small blisters. The applicant noted that all acceptance criteria were met.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M40 was evaluated.

UFSAR Supplement. LRA Section A.1.27 provides the UFSAR supplement for the Neutron-Absorbing Material Monitoring Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

In a letter dated September 24, 2015, the applicant provided supplemental information revising LRA Section A.1.27 to cover all neutron-absorbing material other than Boraflex (i.e., including, but not limited to, Boral) for the period of extended operation.

The staff also noted that the applicant committed to ongoing implementation of the existing Neutron-Absorbing Material Monitoring Program for managing the effects of aging for applicable components during the period of extended operation.

The staff finds that the information in the UFSAR supplement, as amended by letter dated September 24, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Neutron-Absorbing Material Monitoring Program, as amended by letter dated September 24, 2015, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Oil Analysis

Summary of Technical Information in the Application. LRA Section B.1.32 describes the existing Oil Analysis Program as consistent, with enhancements, with GALL Report AMP XI.M39, "Lubricating Oil Analysis." The LRA states that the AMP addresses loss of material for aluminum, carbon steel, copper-alloy, and stainless steel components exposed to lubricating oil by periodically sampling for water and particulates. The LRA also states that the AMP addresses fouling on heat exchanger tubes and fins exposed to lubricating oil.

A one-time inspection activity will be performed to verify the effectiveness of the Oil Analysis 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.M39. 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.1.32 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that procedures will be revised to identify components within the scope of the program. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M39 and finds it acceptable because, when it is implemented, it will be consistent with the guidance in the GALL Report AMP.

Enhancement 2. LRA Section B.1.32 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that procedures will be revised to provide a formalized analysis technique for particulate counting. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M39 and finds it acceptable because, when it is implemented, it will be consistent with the guidance in the GALL Report AMP.

Enhancement 3. LRA Section B.1.32 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that procedures will be revised to include the sampling and testing recommendations of equipment manufacturers or industry standards. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M39 and finds it acceptable because, when it is implemented, it will be consistent with the guidance in the GALL Report AMP.

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. 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.1.32 summarizes operating experience related to the Oil Analysis Program.

In 2004, an oil sample taken from the SLC pump gearbox for analysis, and the results indicated high severe wear index. Followup vibration readings were high. The pump was removed from service, and an investigation determined that there was a low oil level. The gearbox was inspected with no abnormalities noted. The gear box was cleaned out, new oil was added, and the pump was restored back to service.

In 2007, the reactor core isolation cooling turbine was declared inoperable due to excessive water in the oil sample. The excessive water content was caused by leaking valve internals and inadequate draining during PM. Although the condition was not attributed to oil degradation due to aging, the program was enhanced to entail selection of a better sampling location.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M39 was evaluated.

UFSAR Supplement. LRA Section A.1.32 provides the UFSAR supplement for the Oil Analysis Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Oil Analysis Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Protective Coating Monitoring and Maintenance

Summary of Technical Information in the Application. LRA Section B.1.36 describes the existing Protective Coating Monitoring and Maintenance Program as consistent, with enhancements, with GALL Report AMP XI.S8, "Protective Coating Monitoring and Maintenance Program." The LRA states that the AMP monitors and maintains Service Level I coatings applied to carbon steel and concrete surfaces inside containment (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors). The LRA states that the AMP proposes to assess coating conditions through visual inspections by identifying degraded or damaged coatings and by providing a means for repair of identified problem areas.

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.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," 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.1.36 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that it will revise plant procedures to include Service Level I coating applied to steel and concrete surfaces of the steel containment vessel. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S8 and finds it acceptable because the GALL Report recommends including all accessible Service Level I coating applied to steel and concrete surfaces inside containment as part of the scope for this AMP. The staff finds that when this enhancement is implemented it, will make the AMP consistent with the recommendations of GALL Report AMP XI.S8.

Enhancement 2. LRA Section B.1.36 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that it will revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM Standard D5163-08 (ASTM D5163-08), "Standard Guide for Establishing a Program for Condition Assessment of Coating Service Level I Coating Systems in Nuclear Power Plants," dated November 1, 2008. In addition, the applicant stated that it will revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S8 and finds it acceptable because the GALL Report recommends using ASTM D5163-08 for guidance on identifying parameters that should be monitored and inspected. The staff finds that, when this enhancement is implemented, it will make the AMP consistent with the recommendations of GALL Report AMP XI.S8.

Enhancement 3. LRA Section B.1.36 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08. The applicant also stated that it will revise plant procedures to develop an inspection plan and to specify inspection methods to be used in accordance with subparagraph 10.1 of ASTM D5163-08. The applicant stated that it will revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties should be as defined in ASTM Standard D7108 (ASTM D7108), "Standard Guide for Establishing Qualifications for a Nuclear Coatings Specialist," Revisions September 1, 20015, and November 15, 2012. The applicant further stated that qualification of inspection personnel who perform these inspections shall be as specified in ASTM Standard D4537 (ASTM D4537), "Standard Guide for Establishing Procedures to Qualify and Certify Personnel Performing Coating and Lining Work Inspection in Nuclear Facilities," Revision March 1, 2012 The applicant stated that it will revise plant procedures to specify a protective-coatings program owner or an equivalent to a nuclear-coating specialist, as defined in ASTM D5163-08, and that will have general duties and responsibilities similar to those defined in Section 5 of ASTM D7108, Revision 2005. In addition, the applicant stated that it will revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the emergency core cooling system. The applicant also stated that it will revise plant procedures to specify instruments and equipment needed for inspection as identified in subparagraph 10.5 of ASTM D5163-08. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S8 and finds it acceptable because the GALL Report recommends using ASTM D5163-08 for guidance on performing inspections. The staff reviewed ASTM D7108, Revisions 2005 and 2012, and finds them acceptable because the standards provide guidance on developing a qualification program for a nuclear-coating specialist. The staff also reviewed ASTM D4537, Revision 2012, and finds it acceptable because the standard provides guidance on qualification and certification of personnel who perform inspection of coating and lining work. The staff finds that, when this enhancement is implemented, it will make the AMP consistent with the recommendations of GALL Report AMP XI.S8.

Enhancement 4. LRA Section B.1.36 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that it will revise plant procedures to specify that, upon the completion of a planned RFO, a coatings outage summary report will be prepared for the coating work performed in Service Level I areas during the outage. The applicant further stated that the summary report will prioritize repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period. The applicant also stated that it will revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed before the inspection or monitoring process. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S8 and finds it acceptable because the GALL Report recommends developing and maintaining inspection reports that prioritize repair areas and that identify other areas that should be under surveillance in interim periods. GALL Report AMP XI.S8 also recommends performing a pre-inspection review of the previous two monitoring reports. The staff finds that, when this enhancement is implemented, it will make the AMP consistent with the recommendations of GALL Report AMP XI.S8.

Enhancement 5. LRA Section B.1.36 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that it will revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and 10.4 of ASTM D5163-08. The applicant also stated that it will revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S8 and finds it acceptable because the GALL Report recommends using ASTM D5163-08 for guidance on performing inspections. The staff finds that, when this enhancement is implemented, it will make the AMP consistent with the recommendations of GALL Report AMP XI.S8.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S8. In addition, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.36 summarizes operating experience related to the Protective Coating Monitoring and Maintenance AMP. The LRA states that the operating experience on monitoring of primary containment pressure boundary coatings has been obtained under ASME Code Section XI-IWE.

The applicant provided the following operating experience.

In 2003, degraded coatings were identified during ASME Code CII IWE primary containment inspections. The LRA notes that several areas required simple recoating and other areas required cleaning of rust and recoating. Furthermore, the LRA states that in none of the cases had the primary containment boundary been degraded.

In 2005, degraded coatings were identified during ASME Code CII IWE inspections of the torus shell coating. The areas identified involved the loss of torus protective coating; however, the torus shell material was not degraded. The applicant attributed the failure of the torus coating to inadequate curing of the initial coating. As a result, the applicant modified the ASME Code CII IWE program to require divers to inspect the torus coatings every other outage.

In 2012, the applicant identified and repaired broken blisters, mechanical damage, and pinpoint rust in wetted areas of the torus. The applicant stated that all flaking paint was removed from the torus ring header, torus vacuum breaker valves, nitrogen supply lines, monorail rail, and torus walkway and handrail of the torus vapor region. In addition, the applicant removed flaking or cracked coating and reapplied protective coating to the torus shell. The total collective surface area of underwater coating repairs performed is estimated at 607 square inches.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S8 was evaluated.

UFSAR Supplement. LRA Section A.1.36 provides the UFSAR supplement for the Protective Coating Monitoring and Maintenance AMP. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff also noted that the applicant committed to ongoing implementation of the existing Protective Coating Monitoring and Maintenance AMP for managing the effects of aging for applicable components during the period of extended operation.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Protective Coating Monitoring and Maintenance AMP, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Reactor Head Closure Studs

Summary of Technical Information in the Application. LRA Section B.1.37 describes the existing Reactor Head Closure Studs Program as consistent, with exceptions and enhancements, with GALL Report AMP XI.M3, "Reactor Head Closure Stud Bolting." The LRA states that the Reactor Head Closure Studs Program provides for ASME Code Section XI inspections of reactor head closure studs, associated nuts, bushings, flange threads, and washers for cracking and loss of material. The LRA also states that the program is based on the examination and inspection requirements specified in ASME Code Section XI and that it uses preventive measures described in NRC RG 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," dated April 2010.

The LRA also includes exceptions to the program. Because the GALL Report recommends use of bolting material for closure studs that has actual measured yield strength less than 150 ksi, the applicant stated that it cannot verify actual measured yield strength of bolting material for closure studs and, therefore, assumed that it is higher than 150 ksi.

In addition, the program includes enhancements to ensure that replacement studs are fabricated from material with actual measured yield strength less than 150 ksi. The program also includes an enhancement to specifically exclude the use of MoS_2.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program with the corresponding program elements of GALL Report AMP XI.M3.

The staff also reviewed the portions of the "preventive actions" and "corrective actions" program elements associated with an exception and two 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 exception and enhancements follows.

Exception. LRA Section B.1.37 includes an exception to the "preventive actions" and "corrective actions" program elements. In this exception, the applicant stated that it cannot verify the actual measured yield strength of bolting material for closure studs and, therefore, assumed that the yield strength for the closure studs is higher than 150 ksi. The staff reviewed the applicant's exception and justification for the adequacy of the AMP to manage SCC in the high strength material and finds it acceptable. The staff compared this exception against the corresponding program elements of GALL Report AMP XI.M3 and finds it acceptable because (a) the program includes ultrasonic examination of each closure stud during each inspection interval, which provides reasonable assurance that SCC in closure studs can be detected and adequately managed before loss of intended function and (b) the volumetric examinations of the closure studs have not detected any evidence of SCC.

Enhancements 1 and 2. LRA Section B.1.37 includes two enhancements to the "preventive actions" and "corrective actions" program elements. In these enhancements, the applicant stated that it will revise the "preventive actions" and "corrective actions" program elements to ensure that replacement studs are fabricated from bolting materials with actual measured yield strength less than 150 ksi. In addition, the applicant will revise the “preventive actions” program element to specifically include a statement in its program procedures, which excludes the use of MoS_2 on reactor vessel closure studs. The staff reviewed these enhancements against the corresponding program elements in the GALL Report AMP and determined that these enhancements, when implemented, will make the AMP adequate to manage the applicable aging effects.

Based on its audit and review of the applicant’s Reactor Head Closure Studs Program, the staff finds that the program elements 1 through 6, for which the applicant claimed consistency with the GALL Report, are consistent with the corresponding program elements of GALL Report AMP XI.M3. The staff also reviewed the exception associated with the “preventive actions” and “corrective actions” program elements and their justifications and finds the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “preventive actions” 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.1.37 summarizes operating experience related to the Reactor Head Closure Studs Program. The applicant stated that ultrasonic examinations performed on the closure studs and flange threads from 2006 to 2010 confirmed that there were no recordable indications. The applicant also stated that there has been no history of degradation and that there have been no deficiencies noted from past inspection activity for this program.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M3 was evaluated.

UFSAR Supplement. LRA Section A.1.37 provides the UFSAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation.

Conclusion. On the basis of its audit and review of the applicant’s Reactor Head Closure Studs Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justification and determines that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Reactor Vessel Surveillance

Summary of Technical Information in the Application. LRA Section B.1.38 describes the existing Reactor Vessel Surveillance Program as consistent, with an enhancement and an exception, with GALL Report AMP XI.M31, "Reactor Vessel Surveillance." This program manages reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement and monitors reactor vessel long-term operating conditions that could affect neutron irradiation embrittlement of the reactor vessel. The objective of the program is to provide sufficient material and dosimetry data to (a) monitor irradiation embrittlement at the end of the period of extended operation and (b) determine the need for operating restrictions on the inlet temperature, neutron spectrum, and neutron flux. The program includes all reactor vessel beltline materials and complies with the requirements of Appendix H to 10 CFR Part 50 for reactor vessel material surveillance. Fermi 2 participates in the BWRVIP ISP in accordance with BWRVIP-86, "Updated BWR Integrated Surveillance Program (ISP) Implementation Plan," Revision 1-A, dated October 2012, as approved by the NRC.

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. The staff also reviewed the portions of the "detection of aging effects" program element associated with an exception and the "monitoring and trending" program element associated with an enhancement in order to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the program exception and enhancement follows below.

In addition, the staff noted that this program provides material and neutron dosimetry data to be used in the reactor vessel neutron embrittlement TLAAs. The staff's review of the applicant's TLAAs for reactor vessel neutron fluence, ARTs, P-T limits, and USE are documented in SER Sections 4.2.1, 4.2.2, 4.2.3, and 4.2.4, respectively.

Exception. LRA Section B.1.38 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that the GALL Report recommends that the reactor vessel surveillance program shall have at least one capsule with projected neutron fluence equal to, or exceeding, the 60-year peak reactor vessel wall neutron fluence before the end of the period of extended operation. The exception also states that a capsule meeting this qualification is not expected to be obtained before the end of the period of extended operation.

In its review of the exception, the staff noted that LRA Section B.1.38 indicates that the applicant participates in the BWRVIP ISP, which is described in BWRVIP-86, Revision 1-A. The staff also noted the following reference addresses technical information related to ISP surveillance materials for the applicant's reactor vessel:

- Tables 4-5 and 4-6 of GE Report NEDO-33133, “Pressure-Temperature Curves for DTE Energy Fermi Unit 2,” Revision 0, dated February 2005 (ADAMS Accession No. ML050870587)

In addition, the staff noted that the BWRVIP ISP includes a surveillance weld material that represents the applicant’s reactor vessel target welds (i.e., lower shell axial welds). In the BWRVIP ISP, a target weld or plate material is the specific vessel material to which the ISP test matrix assigns a representative surveillance material. The staff also noted that the ISP includes a surveillance plate material that represents the applicant’s vessel target plates (i.e., lower and lower intermediate shell plates). The staff further noted that each of these surveillance materials was irradiated or is being irradiated in one of the host reactor vessels, which are different from the applicant’s reactor vessel, as planned in the ISP.

The staff noted that the BWRVIP ISP tested the surveillance weld material at neutron fluence levels greater than 1.43×10^{18} n/cm^2 (E > 1 MeV), as described in the following references:

- Table 5-1 of EPRI BWRVIP-111NP, “BWR Vessel and Internals Project: Testing and Evaluation of BWR Supplemental Surveillance Program Capsules E, F, and I,” Revision 1, dated August 2010 (ADAMS Accession No. ML080780267)
- Table 5-2 of EPRI BWRVIP-87NP, “BWR Vessel and Internals Project: Testing and Evaluation of BWR Supplemental Surveillance Program Capsules D, G, and H,” Revision 1, dated September 2007 (ADAMS Accession No. ML080770344)

In comparison, LRA Section 4.2.1 states that the applicant’s peak reactor vessel wall fluence for 60 years of operation is 1.43×10^{18} n/cm^2 (E > 1 MeV), which indicates that the neutron fluence levels of the tested surveillance weld material exceed the peak reactor vessel wall fluence for 60 years of operation (52 EFPY).

In its review, the staff also noted that the BWRVIP ISP has a plan to test the representative surveillance plate material for the applicant’s reactor vessel before the end of the period of extended operation at an estimated neutron fluence between one and two times the applicant’s peak reactor vessel wall fluence for 52 EFPY, consistent with GALL Report AMP XI.M31.

As discussed above, the staff noted that the neutron fluences (E > 1 MeV) of the ISP surveillance weld and plate materials, which represent the applicant’s reactor vessel materials, range between one and two times the peak reactor vessel wall fluence for 60 years of operation. However, the program exception identified in the LRA indicates that the applicant’s program does not include a surveillance capsule that meets the fluence range specified in the GALL Report for the period of extended operation. Therefore, additional clarification was necessary to resolve this apparent inconsistency between the program exception and the ISP surveillance capsule withdrawal schedule for the applicant’s reactor vessel.

By letter dated December 4, 2014, the staff issued RAI B.1.38-1 requesting that the applicant clarify whether its program includes a surveillance capsule that meets the neutron fluence range specified in the GALL Report for the period of extended operation. The staff also requested that, as part of the response, the applicant clarify whether the capsule withdrawal schedule and associated fluences of the ISP for its reactor vessel have been changed or updated in such a manner that a program exception needs to be identified.

In its response dated January 5, 2015, the applicant stated that the intent of the exception was not to circumvent participation in a reactor vessel surveillance program as recommended by the

GALL Report. The applicant also stated that it identified the exception because a capsule with the representative surveillance materials is not physically located within the Fermi 2 reactor vessel. The applicant further stated that Fermi 2 License Amendment No. 152 approved the participation of the plant in the BWRVIP ISP. In addition, the applicant stated that, through the ISP, Fermi 2 representative surveillance materials with the appropriate peak fluences are tested in accordance with Appendix H to 10 CFR Part 50. The applicant also indicated that, because it maintains participation in the BWRVIP ISP consistent with the provisions of GALL Report AMP XI.M31, the LRA is revised to remove this exception.

The staff finds the applicant's response acceptable because (a) the applicant clarified that the representative surveillance materials with the appropriate peak neutron fluences are tested through the BWRVIP ISP in accordance with Appendix H to 10 CFR Part 50 and GALL Report AMP XI.M31, (b) the guidance of GALL Report AMP XI.M31 permits use of ISP capsules irradiated in other reactors, and (c) the applicant provided adequate revisions to the LRA to delete the program exception based on consistency with GALL Report AMP XI.M31. The staff's concern described in RAI B.1.38-1 is resolved.

Enhancement. LRA Section B.1.38 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that it will revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline ART tables are provided to the BWRVIP before the period of extended operation.

The staff noted that the applicant's Reactor Vessel Surveillance Program is an existing program and that, upon receipt of a renewed license, the applicant's program should continue to provide adequate fracture toughness and dosimetry data throughout the license renewal term. However, the staff noted that the LRA states that the applicant's enhancement regarding data sharing of new fluence projections and associated ART tables will be implemented before the period of extended operation but not within a specific time period upon receipt of the renewed license.

By letter dated December 4, 2014, the staff issued RAI B.1.38-2 requesting that the applicant provide adequate justification for why the program enhancement regarding data sharing of new fluence projections and associated ART tables will not be implemented within a specific time period upon receipt of renewed license.

In its response dated January 5, 2015, the applicant stated that the Fermi 2 Reactor Vessel Surveillance Program has been integrated into the BWRVIP ISP, which follows the provisions of BWRVIP-86, Revision 1-A, and the latest revision to BWRVIP-135, "BWRVIP ISP Data Source Book and Plant Evaluations." The applicant also stated that Item 10, "Licensee Responsibilities Regarding Information Exchange," of Section 3 of Revision 2 to BWRVIP-135 states that all plants are responsible to notify the BWRVIP of any changes in fluence projections for RPV (inner diameter and 1/4T), fluence values for any previously withdrawn capsules (due to recalculated fluence), latest vessel beltline ART tables, and placement and location of all capsules. The applicant further stated that this guidance is already in place to ensure that the transmittal of new fluence projections and associated ART tables in support of license renewal are shared with the BWRVIP.

In addition, the applicant stated that the requirements in BWRVIP-86 or BWRVIP-135 do not indicate a specific time period in which new fluence projections and ART tables must be provided to the BWRVIP. The applicant stated that the intent of the enhancement to ensure that the identified information would be provided before the period extended operation is to formalize the need for information exchange, specifically for license renewal. The applicant also confirmed that Fermi 2 has had no previous issues in promptly submitting changes affecting the requested information to the BWRVIP. The applicant further stated that, for example, revised ART tables due to the Measurement Uncertainty Recapture/Thermal Power Optimization project implemented in early 2014 were submitted to the BWRVIP in March 2013 and January 2014. The applicant stated that no additional enhancement is necessary.

During its review of the RAI response, the staff noted that Section 5.7, “Planning for ISP Changes,” of Revision 1 to BWRVIP-86 states the following:

> As time progresses, actual plant operating experience will provide more accurate data about each plant for predicting end-of-life vessel fluences and target capsule fluence values. This information will be factored into the ISP planning and, if necessary, adjustments will be made to the remaining capsule test matrix and withdrawal schedule in order to maintain an optimized program. Minor reassessments in the ISP test matrix will take into account plant-specific variations in scheduled withdrawal dates due to modifications in fuel cycles, or changes in target fluences caused by power uprates or variation in capacity factor. For example, target fluences in the original plan assume a nominal capacity factor of 80 percent for all BWR plants, and actual plant operation may vary from this assumed value.

The staff noted that Revision 1 to BWRVIP-86 indicates that the BWRVIP ISP continues to consider updated reactor vessel fluence values in the ISP planning in order to maintain an optimized program. The staff also noted that, upon receipt of a renewed license, the new fluence projections and ARTs are incorporated into the applicant’s CLB. The staff further noted that this CLB information should be communicated with the BWRVIP in a timely manner to ensure the effectiveness of the ISP. By contrast, the staff noted that the applicant’s response did not provide sufficient justification for why its enhancement regarding the data sharing will be implemented before the period of extended operation but not within a specific time period upon receipt of a renewed license. In addition, it was not clear to the staff what the timeframe is for sharing fluence projections and associated ARTs with the BWRVIP when these values are revised.

By letter dated February 11, 2015, the staff issued RAI B.1.38-2a requesting that the applicant provide sufficient justification for why its program enhancement regarding the data sharing of new fluence projections and associated ARTs will not be implemented within a specific time period upon receipt of a renewed license. The staff also requested that the applicant clarify the timeframe for sharing fluence projections and associated ARTs with the BWRVIP when these values are revised.

In its response dated March 6, 2015, the applicant stated that, as discussed in the response to RAI B.1.38-2, BWRVIP guidelines do not define a specific time period for data sharing of new fluence projections and associated ARTs upon their acquisition by the utility. The applicant also stated that it will continue to follow the provisions of BWRVIP-135 and BWRVIP-86 for “Licensee Responsibilities Regarding Information Exchange.” The applicant further clarified that data relevant to license renewal will be provided to the BWRVIP in a manner consistent with previous Fermi 2 data submittals. In addition, the applicant stated that the program enhancement for this activity is deleted because Fermi 2 has had no issues in submitting the requested information to the BWRVIP as previously indicated in its response to RAI B.1.38-2.

In its review, the staff finds the applicant's response acceptable because it clarified that the fluence and ART data relevant to license renewal will be provided to the BWRVIP in a manner consistent with the previous data submittals, which had no issues in promptly submitting changes affecting the requested information to the BWRVIP. The staff also finds that the deletion of the enhancement is acceptable because the applicant confirmed that it will continue to share relevant data with the BWRVIP in a manner consistent with the CLB and previous data submittals (such as prompt data sharing related to the 2014 implementation of the Measurement Uncertainty Recapture/Thermal Power Optimization project). The staff's concern described in RAIs B.1.38-2 and B.1.38-2a is resolved.

Based on its audit, and review of the applicant's responses to RAIs B.1.38-1, B.1.38-2 and B.1.38-2a, 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.M31. 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 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.1.38 summarizes operating experience related to the applicant's Reactor Vessel Surveillance Program. The applicant cited its participation in the BWRVIP ISP. The applicant also indicated that the best representative surveillance capsules available were chosen to represent its reactor vessel materials in the BWRVIP ISP and that results of the surveillance material test and analysis were used in the preparation of the P-T limit curves for Fermi 2. The applicant further indicated that this example of operating experience provides confidence that continued implementation of the Reactor Vessel Surveillance Program will effectively manage reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement. The applicant stated that continued participation in the BWRVIP ISP provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the CLB through the period of extended operation.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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.M31 was evaluated.

UFSAR Supplement. LRA Section A.1.38, as amended by letter dated February 11, 2015, provides the UFSAR supplement for the applicant's Reactor Vessel Surveillance Program. The staff reviewed the UFSAR 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 of the applicant's UFSAR supplement against SRP-LR Table 3.0-1, the staff finds that the UFSAR supplement is an adequate summary description of the applicant's Reactor Vessel Surveillance Program.

Conclusion. On the basis of its audit and review of the applicant's Reactor Vessel Surveillance Program and responses to RAIs B.1.38-1, B.1.38-2, and B.1.38-2a, 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. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP, as amended by letter dated February 11, 2015, and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants

Summary of Technical Information in the Application. LRA Section B.1.39, as revised by letter dated December 26, 2014, describes the existing RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as consistent, with enhancements, with GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." The LRA states that Fermi 2 is not committed to the requirements of NRC RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," dated March 1978; however, the program at Fermi 2 was developed based on guidance in Revision 1 to RG 1.127 and provides ISIs and surveillance for the Fermi 2 slopes, channels, and raw water-control structures associated with emergency cooling water systems or flood protection. The LRA also states that the scope of the Fermi 2 program includes water-control structures within the scope of license renewal, as delineated in 10 CFR 54.4, as well as structural steel, structural bolting, and miscellaneous steel associated with these water-control structures. The LRA further states that the program is implemented as part of the Structures Monitoring Program (LRA Section B.1.42) and proposes to manage age-related deterioration and degradation due to extreme environment conditions and the effects of natural phenomena through periodic visual inspections and maintenance so that aging effects can be prevented or mitigated in a timely manner.

The LRA states inspections are conducted by, or under, the direction of qualified engineers. The LRA also states that the program provides guidance on engineering data compilation, inspection activities, technical evaluation, inspection frequency, and the content of inspection reports as required to minimize the possibility of overlooking significant features and that technical evaluations are performed if observed degradations have the potential to impact the intended function of water-control structures.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S7. For the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "scope of program" program element in GALL Report AMP XI.S7 recommends including in the scope of the program structural steel and structural bolting associated with water-control structures, steel or wood piles, and sheeting required for the stability of embankments and channel slopes, as well as miscellaneous steel, such as sluice gates and trash racks. The applicant's RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program states that the program "performs periodic visual examinations to monitor the condition of water control structures and structural components, including…steel piles required for the stability of the shore barrier." However, during its audit, the staff found that the applicant does not plan to perform visual inspections of the submerged steel piles at the shore barrier. By letter dated November 25, 2014, the staff issued RAI B.1.39-2 requesting that the applicant clarify whether the steel piles at the shore barrier will be managed for age-related degradation through visual inspections as described in the LRA and, if not, describe how the proposed AMP will adequately manage the effects of aging during the period of extended operation.

In its response dated December 26, 2014, the applicant stated that the steel pile component of the shore barrier was conservatively included in the LRA as in scope and subject to an AMR. The applicant also stated that, based on further evaluation and on information presented in the applicant's response dated December 26, 2014, the steel sheet pile component of the Fermi 2 shore barrier does not perform the intended functions of "Flood Barrier" and "Support for Criterion (a)(1) Equipment" previously specified in the LRA. To support this conclusion, the applicant also stated that the shore barrier construction specification, as referenced in Figure 2.4-22, "Shore Barrier Design," of the UFSAR indicates that the steel sheet piling was installed solely to facilitate shore barrier construction activities and is procured as a QA Level III component. The applicant revised the LRA to indicate that the steel sheet pile component of the shore barrier is not within the scope of license renewal.

The staff finds the applicant's response acceptable because the staff's review of the referenced Figure 2.4-22 and Subsection 2.4.5, "Probable Maximum Surge and Seiche Flooding," and Subsection 3.4.4, "Flood Protection," of the UFSAR verify that the steel sheet piling is not credited as part of the shore barrier function (i.e., required for stability) and confirm that the steel sheet piling was installed as a QA Level III component. The information provided in the applicant's response demonstrates that the steel sheet pile component of the shore barrier does not perform an intended function within the scope of license renewal as described in 10 CFR 54.4 and, therefore, is not subject to an AMR. The staff's concern described in RAI B.1.39-2 is resolved.

The "detection of aging effects" program element in GALL Report AMP XI.S7 recommends periodic inspections to be performed at least once every 5 years with provision for increased inspection frequency if the extent of the degradation is such that the structure or component may not meet its design basis if allowed to continue uncorrected until the next normally scheduled inspection. However, during its audit, the staff found that the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program appears to lack a provision for increased inspection frequency of water-control structures as recommended in GALL Report AMP XI.S7. By letter dated November 25, 2014, the staff issued RAI B.1.39-1 requesting that the applicant state how the program is consistent with the GALL Report provision for identifying and addressing the need to increase inspection frequency or provide the technical justification for the exception to the GALL Report recommendation.

In its response dated December 26, 2014, the applicant stated that the Structures Monitoring Program in LRA Section B.1.42, which implements the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program, already contains a provision for increased inspection frequency and trending of SCs in accordance with 10 CFR 50.65(a)(1). The applicant also stated that this existing provision is consistent with the GALL Report recommendation for identifying and addressing the need to increase inspection frequency to adequately manage the effects of aging during the period of extended operation. The applicant further stated no additional enhancement was provided to the "detection of aging effects" program element in either LRA Section B.1.42 or LRA Section B.1.39 because this provision is in the existing Structures Monitoring Program.

The staff finds the applicant's response acceptable because the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program is implemented as part of the planned enhancement of the existing Structures Monitoring Program, which has provisions for increased inspection frequency for those SCs in scope of the RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants Program," when the extent of the degradation is such that the structure or component may not meet its design basis if allowed to continue uncorrected until the next normally scheduled inspection. This existing provision in the Structures Monitoring Program is consistent with the one described in the "detection of aging effects" program element of GALL Report AMP XI.S7. The staff's concern described in RAI B.1.39-1 is resolved.

The "detection of aging effects" program element in GALL Report XI.S7 provides several recommendations, depending on the plant's specific groundwater/soil condition and/or raw water conditions in water-control structures, to address the detection of aging effects for inaccessible below-grade concrete structural elements. However, during its audit, the staff found that the applicant's Structures Monitoring Program, which implements the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program, proposes to manage the aging effects for inaccessible, below-grade concrete structural elements by following similar GALL Report recommendations applicable to plants with nonaggressive groundwater/soil and/or raw water for water-control structures, where the LRA AMP basis document indicates that the Fermi 2 concrete structures are subjected to an aggressive groundwater/soil environment. The staff also noted that in UFSAR Table 2.5-16, "Chemical Analysis of Ground Water," the groundwater tested in Fermi 2 had sulfate content above the 1,500-ppm limit stated in the GALL Report for aggressive groundwater. By letter dated November 25, 2014, the staff issued RAI B.1.42-2, and the subsequent followup RAI B.1.42-2a, by letter dated February 20, 2015, requesting that the applicant clarify how the enhancement of this program element is consistent with that described in the GALL Report AMP for inaccessible areas exposed to aggressive groundwater/soil or provide the basis to justify the adequacy of the proposed exception to manage the aging effects in inaccessible areas if a different criteria other than that described in the GALL Report is being used. The staff notes that this RAI is common to the Structures Monitoring Program and the RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program. Therefore, SER Section 3.0.3.2.22 documents the staff's review and evaluation of the applicant's response to RAI B.1.42-2 and followup RAI B.1.42-2a.

The "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements in GALL Report AMP XI.S7 recommends that high strength (actual measured yield strength more than or equal to 150 ksi) structural bolts greater than 1 inch in diameter should be monitored for SCC and that high strength bolts degradations should be accepted by engineering evaluation or should be subject to corrective actions. However, during its audit, the staff noted that the applicant's program and basis document does not provide sufficient information to determine whether high strength structural bolts (other than ASTM A325, F1852, and A490) are used in the structures and to explain how the AMP will manage SCC. By letter dated November 25, 2014, the staff issued RAI B.1.42-4 requesting that the applicant state whether high strength structural bolts greater than 1 inch in diameter are used in Fermi 2 structures and, if so, explain how the program elements are consistent with the GALL Report recommendations to monitor for SCC through supplemental volumetric or surface examinations. The staff noted that this RAI is common to the Structures Monitoring Program and the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. Therefore, SER Section 3.0.3.2.22 documents the staff's review and evaluation of the applicant's response to RAI B.1.42-4.

The staff also reviewed the portions of the "scope of program," "preventive action," "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 notes that the LRA RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is implemented as part of the Structures Monitoring Program and that the LRA has integrated the enhancements for the RG-1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program with the enhancements to the Structures Monitoring Program. Therefore, SER Section 3.0.3.2.22 document the staff's evaluation of LRA Section B.1.42 enhancements associated with water-control structures.

Based on its audit and review of the applicant's responses to RAIs B.1.39-1, B.1.39-2, B.1.42-2, B.1.42-4, and followup RAI B.1.42-2a, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S7. In addition, the staff reviewed the enhancements associated with the "scope of program," "preventive action," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, which are included with the enhancements to the Structures Monitoring Program, as documented in SER Section 3.0.3.2.22, and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

<u>Operating Experience</u>. LRA Section B.1.39 summarizes operating experience related to the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. A summary of the operating experience is given below.

Between December 2007 and January 2008, the Fermi 2 Structures Monitoring Program identified no significant findings during the inspection of the general service water pump house and RHR complex, but some low significant findings were identified. In response to the items identified as low significance, some panel bolts were tightened, and a nut and clamps were replaced.

Between 2003 and 2012, Fermi 2 shore barrier surveillances identified no discrepancies with the structure, and, in some years, the inspections resulted in an action to remove the debris from the beach.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S7 was evaluated.

UFSAR Supplement. LRA Section A.1.39 provides the UFSAR supplement for the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before September 20, 2024, as part of the Structures Monitoring Program (LRA Section A.1.42).

The staff finds that the information in the UFSAR supplement, as amended by letter dated December 26, 2014, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Service Water Integrity

Summary of Technical Information in the Application. LRA Section B.1.41 describes the existing Service Water Integrity Program as consistent, with enhancements, with GALL Report AMP XI.M20, "Open-Cycle Cooling Water System." The LRA states that the program manages loss of material and fouling as described in the applicant's response to GL 89-13 for safety-related systems exposed to service water systems. The program includes surveillance and control techniques to manage the effects of biofouling, corrosion, erosion, and silting; tests of heat exchangers to verify heat transfer capability; and routine inspection and maintenance activities.

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" program element, the staff identified 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 XI.M20 recommends that the program should address fouling due to microorganisms or macroorganisms. During its audit, the staff noted that previous PM activities identified plugging in the MDCT spray nozzles. However, LRA Table 3.3.2-3 indicates that loss of material is the only aging effect being managed for the flow control nozzles exposed to raw water in the service water system. By letter dated December 19, 2014, the staff issued RAI B.1.41-1 requesting that the applicant justify how the intended function of the nozzles will be maintained without managing fouling for these components. The staff also asked the applicant to determine whether there were other activities associated with its response to GL 89-13 for managing aging effects that were similarly not included in the LRA.

In its response dated January 28, 2015, the applicant stated that fouling is an aging effect requiring management for the MDCT spray nozzles and, therefore, revised LRA Table 3.3.2-3 to add an appropriate AMR item. The applicant stated that LRA Sections A.1.41 and B.1.41 currently include fouling; therefore, neither section required changes. The applicant also provided a listing of other components with aging management activities that are performed in accordance with its GL 89-13 response and confirmed these components are currently included in either LRA Table 3.3.2-3 or LRA Table 3.5.2-2. The staff finds the applicant's response acceptable because the revision to LRA Table 3.3.2-3 now includes the degradation mechanisms, as prescribed by SRP-LR Section A.1.2.1, that have occurred for the flow control nozzles. In addition, the applicant confirmed that all other aging management activities associated with its GL 89-13 response were included in other items within the LRA. The staff's concerns described in RAI B.1.41-1 are resolved.

The staff also reviewed the portions of the "detection of aging effects" and "administrative controls" 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.1.41 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise the Service Water Integrity Program procedures to include inspections to determine whether loss of material due to erosion is occurring in the system. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M20 and finds it acceptable because, when it is implemented, the program will include erosion as an aging mechanism, which is consistent with GL 89-13 and GALL Report AMP XI.M20.

Enhancement 2. LRA Section B.1.41 includes an enhancement to the "administrative controls" program element. In this enhancement, the applicant stated that it will revise the Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with Fermi 2's QA program under Appendix B to 10 CFR Part 50. The staff reviewed this enhancement and finds it acceptable because, when it is implemented, the administrative controls will be consistent with the approach described in Appendix A to the GALL Report.

Based on its audit and review of the applicant's response to RAI B.1.41-1, 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.M20. In addition, the staff reviewed the enhancements associated with the "detection of aging effects" and "administrative controls" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.41 summarizes operating experience related to the Service Water Integrity Program. The LRA discusses inspections of the EDG service water piping in 2007 that identified heavy nodules, which prompted an ultrasonic thickness survey. Additional ultrasonic measurements over several years led to the replacement of the EDG service water piping in the EDG rooms in 2012. The LRA also discusses a fitness for service and life-cycle management plan for the Service Water Integrity Program that included the development of a leak evolution and prediction model as a result of operating experience in 2012.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M20 was evaluated.

UFSAR Supplement. LRA Section A.1.41 provides the UFSAR supplement for the Service Water Integrity Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant included a summary of Commitment No. 33 for the enhancements to the program as part of the UFSAR supplement. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program

Conclusion. On the basis of its audit and review of the applicant's Service Water Integrity Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.22 Structures Monitoring

Summary of Technical Information in the Application. LRA Section B.1.42 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 based on guidance in RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, dated March 1997, and NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, to implement the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The LRA states that the AMP includes the condition monitoring of masonry walls and water-control structures as described in the LRA Masonry Wall Program (LRA Section B.1.25) and in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (LRA Section B.1.39). SER Sections 3.0.3.2.14 and 3.0.3.2.20, respectively, document the staff's evaluations of these AMPs.

The LRA states that inspections are performed at least once every 5 years with provisions for more frequent inspections, when necessary, to ensure that there is no loss of intended functions between inspections. The LRA also states that the program will be enhanced to include provisions for periodic sampling and chemical analysis of groundwater chemistry on a frequency of at least once every 5 years. In addition, for surfaces within the scope of the program that are provided with protective coatings, the program will observe the condition of the paint or coating to identify the absence of degradation of the underlying material.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S6. For the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements in GALL Report AMP XI.S6 recommend the use of preventive actions as discussed in Section 2 of the RCSC report for storage, lubricants, and the potential for SCC when structural bolting consisting of ASTM A325, ASTM F1852, and/or ASTM A490 bolts is used. GALL Report AMP XI.S6 also recommends monitoring for loss of material, loose or missing nuts, and cracking of concrete around the bolts for structural bolting. During its audit, the staff found that the applicant's Structures Monitoring Program basis document addresses ASTM A325 and ASTM A490 bolting. However, the document does not state whether ASTM F1852 twist-off-type bolting is used for structural components and whether this bolting would be inspected within the scope of the Structures Monitoring Program. Therefore, by letter dated November 25, 2014, the staff issued RAI B.1.42 1 requesting that the applicant state whether ASTM F1852 structural bolting is used in Fermi 2 structures, whether the bolt type is within the scope of license renewal, and whether it is subject to aging management to explain how the effects of aging will be adequately managed for the period of extended operation.

In its response dated December 26, 2014, the applicant stated that Fermi 2 does not use ASTM F1852 structural bolting as verified through the review of site structural steel specifications, site bolting and torqueing procedures, and consultations with plant personnel and through the review of site-specific systems related to documents search, materials management, and nuclear inventory. Therefore, the Structures Monitoring Program does not include ASTM F1852 structural bolting. The staff finds the applicant's response acceptable because the applicant confirmed that ASTM F1852 structural bolting is not used at the site and, therefore, is not included in the program. The staff's concern described in RAI B.1.42-1 is resolved.

The "detection of aging effects" program element in GALL Report AMPs XI.S6 and XI.S7 provides several recommendations, depending on the plant's specific groundwater/soil condition (and/or raw water conditions in water-control structures), to address the detection of aging effects for inaccessible below-grade concrete structural elements. The staff noted that the applicant's Structures Monitoring Program proposes an enhancement to (a) inspect normally inaccessible areas as they become accessible due to plant activities and (b) inspect inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring. This enhancement is consistent with the GALL Report recommendations for plants with nonaggressive groundwater/soil and raw water; however, the LRA AMP basis document indicates that the Fermi 2 concrete structures are subjected to an aggressive groundwater/soil environment.

Further, the staff noted that, in UFSAR Table 2.5-16, “Chemical Analysis of Groundwater,” the Fermi 2 groundwater was tested and found to have sulfate content above the 1,500-ppm limit stated in the GALL Report for aggressive groundwater. For plants with aggressive groundwater/soil (with a pH of less than 5.5, chlorides of more than 500 ppm, or sulfates of more than 1,500 ppm) and/or with areas in which the concrete structural elements have experienced degradation, the GALL Report recommends implementing a plant-specific AMP that accounts for the extent of the degradation. From review of the AMP basis documents and proposed enhancement, it was not clear to the staff whether the applicant had considered the need for a plant-specific AMP to manage inaccessible concrete for sites with aggressive groundwater as recommended by the GALL Report.

Therefore, by letter dated November 25, 2014, the staff issued RAI B.1.42 2 requesting that the applicant either (a) clarify how the enhancement of this program element is consistent with that described in the GALL Report AMP for inaccessible areas exposed to aggressive groundwater/soil or (b) provide the basis to justify the adequacy of the proposed exception to manage the aging effects in inaccessible areas.

In its response dated December 26, 2014, the applicant stated that inaccessible areas will be managed as described in the LRA Section B.1.42 enhancement for the “detection of aging effects” program element as modified in its response to RAI 3.5.2.2.2.1-1, dated October 24, 2014. The applicant’s response to RAI 3.5.2.2.2.1-1 states that “[i]f normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of areas in environments where observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible areas.”

The applicant also stated in its response that performing inspections of accessible concrete exposed to different environments, but is experiencing the same aging effect requiring management as the inaccessible concrete, provides an indication of the condition of inaccessible structures. A review of site operating experience and observations from recent site modifications where inaccessible below-grade concrete structural elements became accessible showed no instances of structural degradation indicative of significant degradation of the below-grade inaccessible concrete structures exposed to groundwater/soil. The applicant further stated that the Structures Monitoring Program, as modified in its response to RAI 3.5.2.2.2.1-1 serves as the plant-specific AMP and accounts for the extent of degradation experienced at the site.

The staff reviewed the applicant’s response to RAI B.1.42-2 and found it unacceptable because the applicant did not provide the technical bases to support the claim that consistency with the GALL Report recommendations for plants that have nonaggressive groundwater is acceptable for structures at Fermi 2, which are exposed to aggressive groundwater.

Further, it was not clear whether the applicant has evaluated or has plans to evaluate the effects of its aggressive groundwater on inaccessible concrete. Therefore, by letter dated February 20, 2015, the staff issued followup RAI B.1.42-2a requesting that the applicant provide the technical bases to justify the adequacy of the Structures Monitoring Program to ensure adequate management of degradation due to an aggressive groundwater environment in inaccessible areas of Fermi 2 below-grade concrete structures during the period of extended operation.

In its response dated March 19, 2015, the applicant stated that, as described in UFSAR Sections 2.5.1.2.7 and 2.5.4.11.2, the concrete mix design used for the construction of Fermi 2 below-grade concrete already took into consideration the sulfate levels in the natural groundwater by using sulfate-resistant cement, Type II and Type V Portland cement, for all cement grout and below-grade concrete that will be in contact with groundwater. The applicant also stated that due to the sulfate-resistant cement used for below-grade concrete, the potential degradation due to aggressive groundwater environment would be minimal and the above-grade portion of the same structure subject to year-round weathering would experience higher levels of degradation than below-grade portion of the structures that are protected by the sulfate-resistant cement. The applicant further stated that the Fermi 2 reactor/auxiliary building contains a waterproof membrane for the below-grade concrete, which prevents direct contact with soil, subgrade, or backfill materials. In accordance with Table 4.2 in American Concrete Institute (ACI) 515.1R, "Guide to the Use of Waterproofing, Dampproofing, Protective, and Decorative Barrier Systems for Concrete," dated 1985, providing a positive-side waterproofing barrier system will prevent water from entering the concrete. The applicant stated that, due to this protective barrier and the sulfate-resistant cement used, an aggressive groundwater environment is expected to play a negligible role in degradation of the below-grade concrete. In addition, the applicant stated that past inspections of the Fermi 2 structures under the Structures Monitoring Program and recent site projects that exposed below-grade exterior walls of the structures did not identify degradation attributed to aggressive chemical attack.

The staff finds the applicant's response acceptable because the technical justification provided clarifies that below-grade concrete structures were constructed using sulfate-resistant cement to prevent concrete chemical degradation from occurring and states that no degradation attributed to chemical attacks has been identified thus far in below-grade exterior walls from inspection of exposed concrete surfaces during recent site projects. The staff determined that the applicant has provided sufficient technical basis that the program enhancement to manage the aging effects for inaccessible areas of below-grade concrete structures accounts for the plant-specific design and construction and the extent of degradation experienced at the site as recommended by the GALL Report. The staff's concern described in followup RAI B.1.42-2a is resolved.

The "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements in GALL Report AMP XI.S6 recommend the use of ACI 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," dated 2002, as an acceptable basis for selecting parameters to be monitored or inspected, prescribing quantitative acceptance criteria for concrete, and establishing qualification requirements for I&E personnel. However, during its audit, the staff found that the applicant's Structures Monitoring Program basis document references the 1996 edition of ACI 349.3R, whereas GALL Report AMP XI.S6 is based on, and references, the 2002 edition of ACI 349.3R. By letter dated November 25, 2014, the staff issued RAI B.1.42-3 requesting that the applicant describe how differences between the ACI 349.3R editions referenced in the program basis document and the GALL Report are being addressed to demonstrate consistency with the GALL Report recommendations or provide a technical justification for the exception to the GALL Report recommendations.

In its response dated December 26, 2014, the applicant stated that the provisions of the 2002 edition of ACI 349.3R was considered when assessing the consistency between GALL Report AMP XI.S6 and the Fermi 2 Structural Monitoring Program and that no exception was taken to the GALL Report recommendation. The applicant stated that it did not include reference to a specific edition of the ACI 349.3R so that the program would allow the use of latest version of ACI 349.3R during the development of implementing procedures. For clarification, the applicant revised LRA Sections A.1.42, A.4, and B.1.42 to state the use of a "2002 or later" version of ACI 349.3R.

Based on its review, the staff found that the applicant's response to RAI B.1.42 3 clarifies that there were no inconsistencies between the ACI 349.3R editions referenced in the application because the applicant considered the provisions from the 2002 edition of ACI 349.3R during the LRA review process. However, based on the applicant's revision to the LRA to indicate the use of a "2002 or later" edition/version, the staff was unclear as to whether the applicant plans to use, without adequate justification, a later edition/revision from that referenced in the GALL Report for ACI 349.3R. The staff could not determine whether the applicant would opt to use a different version that has a plant-specific NRC endorsement as allowed by the GALL Report guidance on page XI-3 for adopting a later edition/revision. Therefore, by letter dated February 20, 2015, the staff issued followup RAI B.1.42-3a requesting that the applicant identify the later version of ACI 349.3R that has been endorsed/approved by the NRC and that will be used by the Structures Monitoring Program and identify the plant-specific licensing action that contained the endorsement/approval if a plant-specific NRC endorsement/approval has been provided.

In its response dated March 19, 2015, the applicant stated that the provision of the 2002 version of ACI 349.3R was considered during the review of the Fermi 2 Structures Monitoring Program. The applicant also stated that DTE does not rely on plant-specific NRC endorsement/approval of a later version of ACI 349.3R and that, to be consistent with the code version used to assess the consistency with the GALL Report, the applicant revised the enhancements noted in its responses to RAIs B.1.42-3 and 3.5.2.2.2.1-3 to reflect that only the 2002 version of ACI 349.3R was used to assess the AMP consistency with the GALL Report.

The staff finds the applicant's response acceptable because the applicant revised the program enhancements and the affected responses to reflect the use of the 2002 version of ACI 349.3R in the LRA AMP, which is consistent with that used in the GALL Report AMP. The staff's concern described in followup RAI B.1.42-3a is resolved.

The "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements in GALL Report AMP XI.S6 recommend that high strength (actual measured yield strength greater than or equal to150 ksi) structural bolts in sizes greater than 1 inch in nominal diameter be monitored for SCC, that preventive actions be included in the program to prevent such cracking, and that visual inspections be supplemented with volumetric or surface examinations to detect cracking due to SCC. The staff noted that the SRP-LR states that high strength ASTM A325, F1852, and A490 bolts have not been shown to be prone to SCC and that potential for SCC need not be evaluated for these bolts. During its review of the applicant's program and implementing documents, the staff did not have sufficient information to determine whether there are other high strength structural bolting types (other than ASTM A325, F1852, and A490) used in plant structures and whether these would be managed by the AMP for SCC. By letter dated November 25, 2014, the staff issued RAI B.1.42-4 requesting that the applicant state whether high strength structural bolts greater than 1 inch in diameter are used in Fermi 2 structures and, if so, state how these program elements are consistent with the GALL Report recommendations to monitor SCC-prone bolt types through supplemental volumetric or surface examinations.

In its response dated December 26, 2014, the applicant stated that high strength structural bolts greater than 1 inch in diameter that are within the scope of the Structures Monitoring Program and the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power

Plants Program are not used in Fermi 2 structures, with the exception of the high strength bolts used in the drywell stabilizer assembly. The applicant also stated that the 1-3/8-inch high strength structural bolts used in the drywell stabilizer are type ASTM A325 bolting, which, according to the GALL Report, are not prone to SCC and, therefore, are excluded from the SCC supplemental monitoring.

Through the review of Figure 3.8-25 of the UFSAR, the staff noted that the 1-3/8-inch high strength structural bolts used in the earthquake stabilizer truss system for the drywell provide a civil-structural function, not a pressure-retaining function; therefore, these bolts are not prone to SCC, consistent with guidance in the SRP-LR. The staff finds the applicant's response acceptable because the applicant confirmed that there are no high strength structural bolts greater than 1 inch in diameter within the scope of the Structures Monitoring Program that require age management for SCC. The staff's concern described in RAI B.1.42-4 is resolved.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff noted that the Masonry Wall Program and the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program are implemented as part of the Structures Monitoring Program and that the LRA has included the enhancements for these programs within the enhancements to the Structures Monitoring Program. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.42 includes an enhancement to the "scope of program" program element. In this enhancement (Commitment No. 34a), the applicant stated that plant procedures will be revised to include the following structures to the scope of the Structures Monitoring Program:

- CST and condensate return tank foundations and retaining barrier
- CTG-11 fuel oil storage tank foundation
- independent spent fuel storage installation rail transfer pad
- manholes, handholes, and ductbanks
- shore barrier
- transformers and switchyard support structures and foundations

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will address additional site structures within the scope of license renewal that are not covered by other structural AMPs. This enhancement makes the applicant's "scope of program" program element consistent with the recommendations provided in GALL Report AMP XI.S6, will help monitor and assess the impact of age-related degradation on these structures, and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended functions.

Enhancement 2. LRA Section B.1.42 includes an enhancement to the "scope of program" program element. In this enhancement (Commitment No. 34b), the applicant stated that plant procedures will be revised to include the following structures and structural components to the scope of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program:

- general service water pump house
- RHR complex
- shore barrier

The staff noted that these structures will be inspected as part of the Structures Monitoring Program. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will include additional structures, structural components, component supports, and structural commodities related to water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants that are within the scope of license renewal, which is consistent with the GALL Report provision for inspection of water-control structures. This enhancement makes the applicant's "scope of program" program element consistent with the recommendations provided in GALL Report AMP XI.S7 in that it will help monitor and assess the impact of age-related degradation on these water-control structures and structural components and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended functions.

Enhancement 3. LRA Section B.1.42 includes an enhancement to the "scope of program" program element. In this enhancement (Commitment No. 34c), the applicant stated that plant procedures will be revised to include masonry walls located in in-scope structures of the Masonry Wall Program (LRA Section B.1.25). The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will include masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. This enhancement is consistent with the GALL Report provision for including inspection of masonry walls and makes the applicant's "scope of program" program element consistent with the recommendations provided in GALL Report AMP XI.S5, "Masonry Wall Program." This enhancement will help monitor and assess the impact of age-related degradation on in-scope masonry walls and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended functions.

Enhancement 4. LRA Section B.1.42 includes an enhancement to the "scope of program" program element. In this enhancement (Commitment No. 34d), the applicant stated that plant procedures will be revised to include a list of structural components and commodities within the scope of license renewal to the scope of the Structures Monitoring Program. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will include the structural components, component supports, and structural commodities that are in the scope of license renewal and 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. This enhancement will help monitor and assess the impact of age-related degradation on these structural components and commodities and will provide assurance that the aging degradation can be detected and addressed before there is a loss of intended functions.

Enhancement 5. LRA Section B.1.42 includes an enhancement to the "scope of program" program element. In this enhancement (Commitment No. 34e), the applicant stated that plant procedures will be revised to include a periodic sampling and chemical analysis of groundwater to the scope of the Structures Monitoring Program. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be consistent with the recommendations provided in

GALL Report AMP XI.S6 for including periodic sampling and testing of groundwater. This enhancement will help monitor and assess the impact of age-related degradation on below-grade structures due to exposure to aggressive groundwater and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended functions.

Enhancement 6. LRA Section B.1.42 includes an enhancement to the "preventive actions" program element. In this enhancement (Commitment No. 34f), the applicant stated that plant procedures will be revised to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, EPRI NP-5067, and EPRI TR-104213 for proper selection of bolting material, installation torque or tension, and use of lubricant and sealant for high strength bolting. 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 provide preventive actions as delineated in NUREG-1339 and the other industry standards, as recommended by the GALL Report, to ensure bolting integrity.

Enhancement 7. LRA Section B.1.42 includes an enhancement to the "preventive actions" program element. In this enhancement (Commitment No. 34f), the applicant stated that plant procedures will be revised to include preventive actions from Section 2 of the RCSC report for storage of ASTM A325 and A490 bolting. 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 include preventive actions from industry guidelines for storage of ASTM A325 and ASTM A490 structural bolts, as recommended by the GALL Report, to ensure bolting integrity.

Enhancement 8. LRA Section B.1.42 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement (Commitment No. 34g), the applicant stated that plant procedures will be revised to base the inspection of concrete structures on quantitative criteria from industry codes, standards and guidelines, and considerations from industry and plant-specific operating experience. 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 provide an acceptable basis for selection of parameters to be monitored or inspected for concrete as recommended by the GALL Report and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended function.

Enhancement 9. LRA Section B.1.42 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement (Commitment No. 34g), the applicant stated that plant procedures will be revised to include the following parameters to be monitored for concrete SCs: 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. 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 expand the list of parameters monitored in the existing program to make it consistent with the GALL Report recommendations and will ensure that aging degradation leading to loss of intended functions will be detected and that the extent of degradation will be determined before there is a loss of intended function.

Enhancement 10. LRA Section B.1.42 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement (Commitment No. 34g), the applicant stated that plant procedures will be revised to include chemical analysis to monitor pH, chlorides, and sulfates. 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 allow the applicant to assess the impact of the groundwater on below-grade concrete structures by monitoring the groundwater chemistry. This enhancement makes the applicant's "parameters monitored or inspected" program element consistent with the recommendations provided in GALL Report AMPs XI.S6 and XI.S7.

Enhancement 11. LRA Section B.1.42 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement (Commitment No. 34g), the applicant stated that plant procedures will be revised to monitor the gaps between the structural steel and masonry walls. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will allow detection of deteriorations that could impact the intended function of the masonry walls or potentially could invalidate its evaluation basis. This enhancement makes the applicant's "parameters monitored or inspected" program element consistent with the recommendations provided in GALL Report AMP XI.S5.

Enhancement 12. LRA Section B.1.42 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement (Commitment No. 34h), the applicant stated that plant procedures will be revised to include the following parameters to be monitored for the associated components:

- structural bolting and anchors/fastener for loss of material, loose or missing nuts and bolts, and cracking of concrete around the anchor bolts
- elastomeric vibration isolators and structural sealant for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening)

The staff reviewed this enhancement against the corresponding program element in GALL Report AMPs XI.S6 and XI.S7 and finds it acceptable because, when it is implemented, it will allow detection of deterioration that could impact the intended function of these structural components. This enhancement makes the applicant's "parameters monitored or inspected" program element consistent with the recommendations provided in GALL Report AMPs XI.S6 and XI.S7.

Enhancement 13. LRA Section B.1.42 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement (Commitment No. 34i), the applicant stated that plant procedures will be revised to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments. 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 allow detection of other conditions indicative of loss of preload that could impact the intended function of the component, consistent with the recommendations of the GALL Report AMPs.

Enhancement 14. LRA Section B.1.42, as amended by the applicant's response dated March 19, 2015 to followup RAI B.1.42-3a, includes an enhancement to the "detection of aging effects" program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to state that personnel involved in the I&E of structures and structural components, including masonry walls and water-control structures, meet the qualification guidance in ACI 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," dated 2002. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMPs XI.S5, XI.S6, and XI.S7 and finds it acceptable because, when it is implemented, it will ensure that inspections and evaluations are performed by personnel that meet the qualification requirements of ACI 349.3R, as recommended by the GALL Report.

Enhancement 15. LRA Section B.1.42 includes an enhancement to the "detection of aging effects" program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to supplement visual inspection of elastomeric material with feel or touch to detect hardening if performance of the intended function is suspect. 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 supplemental feel or touch inspection techniques, as recommended by the GALL Report, to allow the detection of additional aging effects (i.e., hardening) that could potentially impact the intended function of elastomeric materials and will provide assurance that the aging degradation can be detected before there is a loss of intended function.

Enhancement 16. LRA Section B.1.42 includes an enhancement to the "detection of aging effects" program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to state that structures and submerged structures will be inspected at least once every 5 years. In its response to RAI B.1.39-1 dated December 26, 2014, the applicant also stated that the Structures Monitoring Program (LRA Section B.1.42) contains provision for increased inspection frequency and trending of SCs in accordance with 10 CFR 50.65(a)(1). 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 structures and submerged structures will be monitored on a frequency not to exceed 5 years, with the provision for more frequent inspections to ensure no loss of intended function between inspections. This enhancement makes the applicant's "detection of aging effects" program element consistent with the recommendations provided in GALL Report AMPs XI.S6 and XI.S7, considering the safety significance and condition of the structures.

Enhancement 17. LRA Section B.1.42, as amended by the applicant's response to RAI 3.5.2.2.2.1-1 dated October 24, 2014, includes an enhancement to the "detection of aging effects" program element. In this enhancement (Commitment No. 34j), the applicant stated that normally inaccessible areas will be inspected as they become accessible due to plant activities and where observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible areas. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMPs XI.S6 and XI.S7 and finds the enhancement acceptable because, when it is implemented, it will be able to provide detection of aging effects for inaccessible concrete structural elements in a manner consistent with the GALL Report recommendations for plants with aggressive groundwater/soil. This enhancement takes into consideration the fact that Fermi 2 below-grade concrete structures were designed and constructed to resist elevated sulfate levels from natural groundwater and the fact that no degradation has been experienced at the site from past inspections under the Structures Monitoring Program for Fermi 2 structures and from recent site projects that have exposed below-grade exterior walls of structures.

Enhancement 18. LRA Section B.1.42 includes an enhancement to the "detection of aging effects" program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to state that sampling and chemical analysis of groundwater will be performed 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 include the sampling and testing of groundwater on a frequency not to exceed 5 years, which is consistent with the inspection frequency recommended by the GALL Report and which accounts for the extent of the degradation experienced at the site.

Enhancement 19. LRA Section B.1.42 includes an enhancement to the “detection of aging effects” program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to state that masonry walls will be inspected at least once every 5 years, with provisions for more frequent inspections to ensure that there is no loss of intended function between inspections. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S5 and finds it acceptable because when, it is implemented, it will be consistent with the recommendation of the GALL Report for performing visual examinations of masonry wall every 5 years, with provisions for more frequent inspections in areas where significant loss of material or cracking is observed to ensure that there is no loss of intended function between inspections.

Enhancement 20. LRA Section B.1.42 includes an enhancement to the “detection of aging effects” program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to state that inspections of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7, and finds it acceptable because, when it is implemented, it will be consistent with the qualification requirements in NRC RG 1.127 for the inspections of water-control structures associated with nuclear power plants, as recommended by the GALL Report.

Enhancement 21. LRA Section B.1.42 includes an enhancement to the “detection of aging effects” program element. In this enhancement (Commitment No. 34j), the applicant stated that plant procedures will be revised to perform inspection of water-control structures on an interval not to exceed 5 years. The applicant also stated, in its response to RAI B.1.39-1 dated December 26, 2014, that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is implemented as part of the Structures Monitoring Program, which already contains provision for increased inspection frequency and trending of SCs in accordance with 10 CFR 50.65(a)(1). The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will be consistent with the GALL Report recommendation for performing periodic inspections of water-control structures at least once every 5 years as described in NRC RG 1.127, with the provision for more frequent inspections to ensure no loss of intended function between inspections.

Enhancement 22. LRA Section B.1.42 includes an enhancement to the “detection of aging effects” program element. In this enhancement (Commitment No. 34, Item j), the applicant stated that plant procedures will be revised to perform special inspections of water-control structures immediately (within 30 days) after the occurrence of significant natural phenomena. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will be consistent with the special inspections requirements in NRC RG 1.127 for inspections of water-control structures associated with nuclear power plants, as recommended by the GALL Report.

Enhancement 23. LRA Section B.1.42, as amended by the applicant's response dated March 19, 2015, to followup RAI B.1.42-3a, includes an enhancement to the "acceptance criteria" program element. In this enhancement (Commitment No. 34k), the applicant stated that plant procedures will be revised to prescribe quantitative acceptance criteria based on ACI 349.3R, 2002 version (ACI 349.3R-02); information provided in industry codes, standards, and guidelines, including ACI 318, "Building Code Requirements for Reinforced Concrete and Commentary," dated 2002; ANSI/ASCE 11, "Guideline for Structural Condition Assessment of Existing Buildings," dated 1999; and relevant AISC specifications; and industry and plant-specific operating experience. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMPs XI.S5, XI.S6, and XI.S7 and finds it acceptable because, when it is implemented, it will provide quantitative acceptance criteria from industry standards that allow for determining the adequacy of observed aging effects and will specify further evaluation criteria to determine the need of corrective actions based on industry codes, specifications, guidelines, standards, and/or operating experience, as recommended by the GALL Report.

Enhancement 24. LRA Section B.1.42, as amended by the applicant's response to RAI B.1.25-1 dated December 26, 2014, includes an enhancement to the "acceptance criteria" program element. In this enhancement (Commitment No. 34l), the applicant stated that plant procedures will be revised to include acceptance criteria for masonry wall inspections, which ensure that observed aging effects do not invalidate the evaluation basis of masonry walls or affect their intended function. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will ensure that observed aging effects on masonry walls do not invalidate the evaluation basis or impact the intended function of the walls, as recommended by the GALL Report.

Enhancement 25. LRA Section B.1.42, as amended by the applicant's response to RAI 3.5.2.2.2.1-3 dated January 26, 2015, includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement (Commitment No. 34m), the applicant stated that plant procedures will be revised to include testing and evaluation of water/mineral deposits where in-leakage is observed in concrete elements and to determine whether leaching of calcium hydroxide and carbonation is occurring, which could impact the intended function(s) of the concrete structures. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will ensure that observed water/mineral deposits from observed in-leakage on accessible concrete areas will be tested and evaluated to identify concrete degradation associated with leaching of calcium hydroxide and carbonation and will provide assurance that this aging degradation can be detected and managed before there is a loss of intended function(s) of the affected concrete structures.

Enhancement 26. LRA Section B.1.42, as amended by the applicant's responses to RAI 3.5.2.2.2.1-3 dated January 26, 2015, and RAI B.1.4-3a dated March 19, 2015, includes an enhancement to the "detection of aging effects" and "corrective actions" program elements. In this enhancement (Commitment No. 34n), the applicant stated that testing and evaluation will be performed before the period of extended operation, to confirm that previously identified conditions are not the result of leaching of calcium hydroxide and carbonation that could impact the intended function(s) of the concrete structures. The water/mineral deposit samples will be tested for mineral and iron content to assess the effect of the water in-leakage on the concrete elements involved, and the results will be used to determine corrective actions in accordance with the corrective action program. 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 for testing and evaluation of previously identified conditions before the period of extended operation and will take corrective actions, as necessary, based on the results.

Based on its audit and review of the applicant's responses to RAIs B.1.42-1, B.1.42-2, B.1.42-3, B.1.42-4, followup RAI B.1.42-2a, followup RAI B.1.42-3a, RAI B.1.25-1, RAI B.1.39-1, RAI 3.5.2.2.2.1-1, and RAI 3.5.2.2.2.1-3, 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 AMPs XI.S5, XI.S6, and XI.S7. In addition, the staff also reviewed the enhancements associated with the "scope of program," "preventive actions," "parameters monitored or inspected," "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.1.42 summarizes operating experience related to the Structures Monitoring Program. The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

The "operating experience" program element in GALL Report AMP XI.S6 recommends considering program enhancements based on observed and reported degradation from operating experience to ensure that the aging effects of SCs are adequately managed during the period of extended operation. However, during its audit, the staff noted that there was plant-specific operating experience involving concrete degradation in accessible areas that was characterized as leaching; however, the applicant's Structures Monitoring Program did not discuss this operating experience or provide any evaluation of the impact of observed leaching of calcium hydroxide and carbonation in accessible areas on the intended function of the concrete structure. Therefore, by letter dated December 23, 2014, the staff issued RAI 3.5.2.2.2.1-3 requesting that the applicant provide a summary of operating experience regarding leaching of calcium hydroxide and carbonation in accessible areas of Groups 1–5 and 7–9 structures. The staff also requested that the applicant state whether an evaluation has been performed to determine the impact on the intended function of the concrete structure and the results. If no evaluation of this condition has been performed for accessible areas of the affected area, the staff issued an RAI to determine whether the program would be adequate to manage this aging effect for inaccessible areas. Item 4, "Aging Management of Inaccessible Areas," of SER Section 3.5.2.2.2 documents the staff's review and evaluation of the applicant's response to RAI 3.5.2.2.2.1-3.

Based on its audit and review of the application and review of the applicant's response to RAI 3.5.2.2.2.1-3, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S6 was evaluated.

UFSAR Supplement. LRA Section A.1.42, as amended by the applicant's response dated March 19, 2015 to followup RAI B.1.42-3a, provides the UFSAR supplement for the Structures Monitoring Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the Structures Monitoring Program before September 20, 2024. The staff finds that the information in the UFSAR supplement, as amended by letters dated October 24, 2014; December 26, 2014; January 26, 2015; and March 19, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Structures Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.23 Water Chemistry Control – Closed Treated Water Systems

Summary of Technical Information in the Application. LRA Section B.1.44, as revised by letter dated March 19, 2015, describes the existing Water Chemistry Control – Closed Treated Water Systems Program as consistent, with an exception and enhancements, with GALL Report AMP XI.M21A, "Closed Treated Water Systems." The LRA states that the AMP manages loss of material, cracking, and fouling in components exposed to a closed treated water environment. The LRA also states that the AMP manages these aging effects through monitoring and control of water chemistry, which includes the use of corrosion inhibitors, chemical testing, and visual inspections of internal surfaces.

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.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with the exception and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the exception and enhancements follows.

Exception. LRA Section B.1.44, as revised by letter dated March 19, 2015, includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that the process sampling system sample cooler loops will be sampled and tested annually. The applicant also stated that the process sampling system sample cooler loops are both small closed-loop cooling systems (approximately 10 to 20 gal). The applicant further stated that the frequent water testing would remove a relatively large percentage of the loop water and would result in refilling and retreatment. The applicant also stated that the small volume of the system limits the amount of water that may leak, making it unlikely that leakage would affect nearby safety-related equipment. The staff noted that GALL Report AMP XI.M21A recommends that closed treated water systems be tested quarterly. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M21A. The staff finds the exception acceptable because it noted that, in a small closed treated water system, quarterly samples taken for testing purposes would remove a relatively large percentage of the treated water and result in unnecessary retreatment. In addition, the frequency of the needed makeup water would inadvertently result in difficulties establishing consistent chemical control and would offset the intended function of the periodic testing to maintain adequate chemistry control of the system. Furthermore, the staff noted that the relatively small volume available in the system also makes any possible leakage from this nonsafety-related system unlikely to adversely affect the nearby safety-related systems.

Enhancement 1. LRA Section B.1.44, as revised by letter dated March 19, 2015, includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the program will be revised to include the process sampling system sample cooler loops and the CCHVAC chill water systems. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M21A and finds it acceptable because the addition of these systems is consistent with the "scope of program" element of GALL Report AMP XI.M21A, which includes closed portions of HVAC systems.

Enhancement 2. LRA Section B.1.44, as revised by letter dated March 19, 2015, includes an enhancement to the "preventive actions" program element. In this enhancement, the applicant stated that the program will be revised to provide chemical treatment, including a corrosion inhibitor for the process sampling system sample cooler loops and the CCHVAC chill water systems in accordance with industry guidelines 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 GALL Report AMP XI.M21A "preventive actions" program element includes the use of corrosion inhibitors as a means of minimizing corrosion.

Enhancement 3. LRA Section B.1.44 includes an enhancement to the "parameters monitored or inspected" and "acceptance criteria" program elements. In this enhancement, the applicant stated that the program will be revised to specify the water chemistry parameters to be monitored and their acceptable range of values in accordance with the closed cooling water chemistry guidance in EPRI TR-1007820, "Closed Cooling Water Chemistry Guidelines," dated April 2004, industry guidance, or vendor recommendations. The staff reviewed these enhancements against the corresponding program elements in GALL Report AMP XI.M21A and finds it acceptable because the GALL Report AMP XI.M21A "parameters monitored and inspected" and "acceptance criteria" program elements specifically recommend that water chemistry concentrations be maintained within limits specified in selected industry documents and guidelines.

Enhancement 4. LRA Section B.1.44 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant will revise the program to include inspections of accessible components whenever the boundary of a closed treated water system is opened and an inspection at least every 10 years of a representative sample of piping and components. The applicant stated that the sample will focus on components most likely to degrade and will comprise 20 percent of each material/environment/aging effect combination with a maximum of 25 components. The applicant also stated that the enhancement would require quarterly water sampling and analysis in accordance with industry guidelines.

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 inclusion of opportunistic and periodic representative sample inspections, along with water sampling and analysis, will make this program element consistent with the “detection of aging effects” program element of the GALL Report AMP. As identified in the Audit Report, although the program basis documentation did not address the inconsistency between the applicant’s current yearly water chemistry test frequency for the CCHVAC chill water system and the quarterly frequency specified in GALL Report AMP XI.M21, the staff concluded that the testing frequency difference would be resolved during implementation of the enhancement.

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 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 “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.1.44 summarizes operating experience related to the Water Chemistry Control – Closed Treated Water Systems Program. The applicant described the identification in 2005 of an increase in the bacterial count for the jacket coolant of an EDG. The applicant entered the issue in the corrective action program and replaced the coolant to correct the problem. The applicant also described the identification in 2005, 2008, and 2009 of high dissolved oxygen content in the turbine building closed cooling water system due to a high makeup rate. The applicant identified and repaired the leakage sources through the corrective action program, and the dissolved oxygen levels returned to within specifications.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects, and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

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

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M21A was evaluated.

UFSAR Supplement. LRA Section A.1.44, as revised by letter dated March 19, 2015, provides the UFSAR supplement for the Water Chemistry Control – Closed Treated Water Systems Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before September 20, 2024. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Water Chemistry 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. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.24 Coating Integrity

Summary of Technical Information in the Application. As amended by letters dated February 5, 2015, and June 9, 2015, LRA Section B.1.45 describes the new Coating Integrity Program as consistent, with exceptions, with GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." The LRA states that the AMP addresses loss of coating integrity for coatings or linings installed on the internal surfaces of in-scope piping, piping components, heat exchangers, and tanks. The LRA also states that loss of coating integrity will be managed by periodic visual inspections by qualified individuals.

Staff Evaluation. The staff issued LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," on November 14, 2014. By letter dated February 5, 2015, the applicant (1) provided the technical basis for why loss of coating integrity is not identified as an applicable AERM for certain internally coated in-scope components and (2) proposed revisions to its LRA to address LR-ISG-2013-01.

In its response, the applicant provided a list of in-scope nonsafety-related components that are located remotely from safety-related components and components that perform an intended function, as described in 10 CFR 54.4(a)(3). The applicant stated that for these nonsafety-related components, there are no downstream detrimental effects due to loss of coating integrity on safety-related components and components that perform an intended function, as described in 10 CFR 54.4(a)(3). The applicant proposed that based on the above criteria, loss of coating integrity would not be cited as an AERM for the following components: condensate backwash tank, hydrogen seal oil vacuum tank, main generator hydrogen gas coolers, reactor recirculation pump seal test fixture, condensate filter demineralizer, and reactor water cleanup filter demineralizers.

The staff finds the applicant's proposal that loss of coating integrity is not an applicable AERM for the above components acceptable because the only components that are within the scope of GALL Report AMP XI.M42 are those for which loss of coating or lining integrity could prevent satisfactory accomplishment of any of the component's or downstream component's CLB intended functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3). In support of this statement, (a) the components are nonsafety related, (b) the applicant justified why leakage through the pressure boundary of the components would not impact a nearby safety-related component, and (c) the applicant's description of the component and its location in the plant provides reasonable assurance that flow blockage will not impact another component's CLB intended functions identified under 10 CFR 54.4(a)(1) and (a)(3).

As amended by letter dated June 9, 2015, the applicant removed the internally galvanized piping associated with its MDCT spray header assemblies from the scope of the Coating Integrity Program. The internally galvanized piping is located outside of the RHR complex pump rooms and is within the MDCT spray areas. The applicant stated that the spray header distributes service water in the cooling tower by a series of spray nozzles. The MDCTs consist of two cells in each of two divisions of cooling towers. Flow blockage for the spray nozzles is addressed in the Service Water Integrity Program, which includes periodic PM visual inspections of the spray pattern for each nozzle. At least one flow cell is tested during every RFO. SER Section 3.0.3.2.21 documents the staff's evaluation of the use of the Service Water Integrity Program to monitor for flow blockage. The applicant also stated that a one-time inspection of the galvanized piping would be conducted in accordance with the One-Time Inspection Program. The inspection will consist of 25 1-ft piping segments. Inspection locations will be based on the risk of material loss. The acceptance criteria are (a) a less than 50-percent wall loss and (b) that, if more than 10 percent of the locations exceed the 50-percent wall loss, periodic inspections consisting of a representative sample of five locations will be conducted every 5 years in accordance with the Periodic Surveillance and Preventive Maintenance Program. The applicant revised LRA Sections A.1.33 and B.1.33 to include the requirement to conduct a one-time inspection of the piping wall thickness.

UFSAR Table 9.2-7, "Ultimate Heat Sink Component Design Parameters," states that the total head of (a) the RHR service water pump is 185 ft, (b) the emergency equipment service water pump is 145 ft, and (c) the diesel generator service water pump is 115 ft. The staff noted it is expected that a 50-percent wall loss will provide sufficient wall thickness to ensure structural integrity because the header pressure is low, resulting in lower pressure stresses. The staff finds the applicant's change to remove the internally galvanized piping associated with the MDCT spray header assemblies from the scope of the Coating Integrity Program acceptable because (a) observing the spray pattern during flow tests conducted during every RFO interval can detect flow blockage due to galvanized coating debris and associated loss of material debris, (b) the resulting spray from a potential through-wall leak will not impact a safety-related function because the galvanized piping is only used in the MDCT spray areas, (c) the location selection criterion and quantity of inspections for the one-time inspection is consistent with the GALL Report recommendations in AMP XI.M32, (d) the criterion to convert to a periodic sampling program from a one-time program, 10 percent of the 25 inspections, is sufficiently low such that a trend will be clearly established, and (e) conducting five inspections every 5 years if the wall thickness acceptance criterion is not met can be sufficient to detect recurring loss of material.

The staff also reviewed the portions of the "detection of aging effects" and "corrective actions" program elements associated with exceptions 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 follows.

<u>*Exception 1*</u>. As amended by letter dated February 5, 2015, LRA Section B.1.45 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that internally coated fire water system components will be inspected on an opportunistic versus periodic basis. The applicant stated that the only internally coated components in the fire water system are buried and consist of cement-lined piping and internally lined replacement isolation valves. The applicant also stated that it conducts routine surveillance tests that are

capable of demonstrating that flow blockage is not occurring. In addition, the fire water system is maintained pressurized, and a low-pressure alarm annunciates in the control room.

The staff noted that as stated in the staff's evaluation of Exception 3 associated with the Fire Water System Program, SER Section 3.0.3.2.10, the applicant conducts main header flow testing every 3 years, 64 hose stations are tested every 3 years to verify no flow blockage, and multiple main drain tests are conducted every 18 months. The fire water system testing is conducted in three different buildings. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M42 and finds it acceptable because (a) there is reasonable assurance that, with the frequency, number, and multiple locations of flow tests that are conducted, flow blockage would be detected just as effectively as if internal visual inspections were being periodically conducted on a portion of the piping in accordance with Table 4a, "Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers," of AMP XI.M42, and (b) the continuous monitoring and low-pressure alarm associated with the fire water system are effective means to detect potential through-wall flaws in the piping and piping components.

Exception 2. As amended by letter dated February 5, 2015, LRA Section B.1.45 includes an exception to the "corrective actions" program element. In this exception, the applicant stated that the HPCI system lube oil reservoir internal coating will not be repaired or replaced. The applicant stated the Nuclear Maintenance Applications Center Terry Turbine Users Group recommends that paint defects should be removed and not recoated.

The staff noted that Section 20.2.5, "Inspection and Maintenance," of EPRI TR-1007459, "Terry Turbine Maintenance Guide, HPCI Application," dated November 2002, states the following: "Remove any damaged preservative paint coating. Do not attempt to repaint the surfaces of the oil reservoir." The staff also noted that the EPRI document was developed to provide maintenance practices that lead to improved turbine reliability. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M42 and finds it acceptable, in part, because the staff's review of EPRI TR-1007459 confirmed that it does not recommend recoating the HPCI turbine oil reservoir when degraded coatings are detected. However, the applicant's exception states that coatings will not be replaced or repaired, whereas TR-1007459 states that damaged preservative coatings should be removed. By letter dated March 26, 2015, the staff issued RAI B.1.45-1 requesting that the applicant state what actions would be taken to mitigate potential further degradation of degraded coatings on the internal surfaces of the HPCI system lube oil reservoir.

In its response dated April 27, 2015, the applicant revised LRA Section B.1.45, Exception 2, to state that "defective, damaged, or degraded preservative paint coating will be removed."

The staff finds the applicant's response acceptable because it will remove degraded coatings and, therefore, ensure that flow blockage will not occur due to further degradation of degraded coatings. The staff's concern described in RAI B.1.45-1 is resolved. The staff reviewed the revised exception against the corresponding program element in GALL Report AMP XI.M42 and finds it acceptable because of the reasons stated above.

Exception 3. As amended by letters dated February 5, 2015, and June 9, 2015, LRA Section B.1.45 includes an exception to the "corrective actions" program element. In this exception the applicant stated that when delamination or peeling is detected during coating inspections and the coatings will be returned to service, physical testing will consist of lightly tapping the coating, light hand scraping, light power tool cleaning, or adhesion testing. The applicant also stated that destructive adhesion testing will not be conducted. The applicant further stated that longer followup and re-inspection inspection intervals than that recommended in GALL Report AMP XI.M42 would be allowed as long as they were technically justified.

The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M42 and does not find it acceptable. The "corrective actions" program element of AMP XI.M42 recommends that in areas in which adhesion testing is not possible due to physical constraints, alternative means of physical testing, such as those described by the applicant, would be acceptable. However, the applicant has not limited these alternative methods to instances in which adhesion testing is not possible. There are nondestructive adhesion testing techniques that can be conducted. Therefore, the applicant's justification is not sufficient because it is based on the conclusion that coatings would be removed down to the base metal if adhesion testing is conducted. In addition, the applicant stated that it might extend inspection intervals beyond those recommended in AMP XI.M42, Table 4a, but did not provide a basis for this portion of the exception beyond stating that a future evaluation would be conducted. By letter dated March 26, 2015, the staff issued RAI B.1.45-2 requesting that the applicant (a) explain why nondestructive adhesion testing cannot be performed when coatings are returned to service with delamination, peeling, or blisters (see Exception 4), (b) explain how lightly tapping the coating, light hand scraping, and light power tool cleaning will be controlled (e.g., procedures and method qualification) to obtain consistent results if nondestructive adhesion testing will not be performed, and (c) state the basis and justification for any inspection intervals beyond those in the "corrective actions" program element of AMP XI.M42.

In its response dated June 9, 2015, the applicant stated that it "will not perform adhesion testing for peeling and delamination where not possible due to physical constraints," that "[a]dhesion testing [where physically possible] will be applied in the case of peeling and delamination that has progressed to the base metal," and that:

> Adhesion testing will be applied in the case of peeling and delamination that has not progressed to the base metal unless both of the following conditions apply: (1) the peeling and delamination is occurring in a tank, pipe, or piping component with laminar or no flow conditions and (2) the scope of interrogation is expanded beyond the damaged area with large margins to ensure that all loose coatings have been removed. If the two conditions apply, then other methods of physical testing may be performed such as those discussed in the response to part b below. This exception will also apply to blisters not repaired.

In Part b of its response, the applicant stated that, if nondestructive adhesion testing is not conducted, it will use light tapping, light hand scraping, or light power tool cleaning to determine the suitability of the coating. The light hand scraping or light power tool cleaning will conform to the provisions of applicable Society of Protective Coatings (SSPC) standards. The applicant provided examples of these standards including SSPC-SP 2, "Hand Tool Cleaning"; SSPC-SP 3, "Power Tool Cleaning"; SSPC-SP 11, "Power Tool Cleaning to Bare Metal"; and SSPC-SP WJ-1, 2, 3, and 4, "Water Jet Cleaning." The applicant also stated that "these cleaning methods 'remove all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.'" The applicant further stated that given that there is no consensus standard document for tap testing, the training provided on this method in the EPRI Comprehensive Coatings Training Course will be credited to ensure that the technique is appropriately used. The applicant stated that the EPRI Comprehensive Coatings Training

Course will be incorporated into site training and qualification requirements for a coating specialist, as well as the tap testing guidance contained in the training course. The applicant revised Exception 4 to include these above alternative provisions to adhesion testing when coatings exhibiting blistering are returned to service without repair. The applicant revised LRA Sections A.1.45 and B.1.45 to incorporate the use of the SSPC standards and the EPRI Comprehensive Coatings Training Course into its CLB.

The applicant further stated that subsequent inspection intervals will be in accordance with the “corrective actions” program element of AMP XI.M42. Repeat visual inspections of degraded coatings that do not meet acceptance criteria but that are returned to service will be performed every 2 years from the date that the degraded condition was detected until the degraded coating is repaired or replaced. The applicant revised Exception 3 to remove the option to conduct inspections at longer inspection intervals than those recommended in AMP XI.M42.

The staff noted that the SSPC standards are industry-wide 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 covered during the course contents. The staff finds the applicant’s response to RAI B.1.45-2 and the alternatives to adhesion testing described in Exceptions 3 and 4 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, (c) performing alternatives to adhesion testing when it is not physically possible to conduct adhesion testing is consistent with AMP XI.M42, (d) in areas in which system flow rates are low (i.e., tanks and piping that experience laminar flow conditions), the applicant provides 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, (e) the applicant included the use of the SSPC standards and the EPRI Comprehensive Coatings Training Course into its CLB, and (f) followup inspection intervals for coatings exhibiting peeling, delamination, and blistering are consistent with AMP XI.M42. The staff’s concern described in RAI B.1.45-2 is resolved. The staff reviewed the revised exception against the corresponding program element in GALL Report AMP XI.M42 and finds it acceptable for the reasons stated above.

Exception 4. As amended by letters dated February 5, 2015, and June 9, 2015, LRA Section B.1.45 includes an exception to the “corrective actions” program element. In this exception, the applicant described alternatives to adhesion testing when coatings exhibiting blistering will be returned to service without repair. The alternatives are as described in Exception 3. The staff’s review of this exception is documented in the response to RAI B.1.45-2 above.

Based on its review of the applicant’s Coating Integrity Program and responses to RAIs B.1.45-1 and B.1.45-2, 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 exceptions associated with the “detection of aging effects” and “corrective actions” program elements and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.45 summarizes operating experience related to the Coatings Integrity Program. The applicant stated that the Coatings Integrity Program is a new program; however, routine inspections had identified coating deficiencies in the main condenser water box coatings, reactor water cleanup resin feed tank, seal oil vacuum tank, and upper main turbine lube oil cooler that the corrective action program addressed.

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. The staff conducted an independent search of the plant operating experience information, using the following keywords: "blister," "block," "clog," "coat," "degrade," "delam," "foul," "holiday," "leak," "lined," "lining," "peel," and "spall" 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.M42 was evaluated.

UFSAR Supplement. As amended through letter dated June 9, 2015, LRA Section A.1.45 provides the UFSAR supplement for the Coating Integrity Program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1, as modified by LR-ISG-2013-01 and noted that the applicant stated the following: "Baseline coating/lining inspections will occur in the 10-year period before the period of extended operation. Subsequent inspections are based on an evaluation of the effect of a coating/lining failure on in-scope component intended functions, potential problems identified during prior inspections, and service life history." The staff also noted that the AMP XI.M42 "detection of aging effects" program element makes virtually the same statement; however, it expands on the statement by stating the following: "[I]nspection intervals should not exceed those in Table 4a, 'Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers.'" The staff further noted that based on the proposed wording in the UFSAR supplement, subsequent inspections may not occur on recommended intervals or may not occur at all. By letter dated March 26, 2015, the staff issued RAI B.1.45-3 requesting that the applicant state the criteria that will be used to determine the maximum duration between coating inspections.

In its response dated April 27, 2015, the applicant revised LRA Section A.1.45 to state that subsequent inspection intervals should not exceed the inspection intervals in Table 4a.

The staff finds the applicant's response acceptable because the inspection intervals will be consistent with Table 4a in AMP XI.M42, which establishes a maximum inspection interval regardless of the results of prior inspections. Therefore, the UFSAR supplement for the Coating Integrity Program is consistent with the corresponding program description in SRP-LR Table 3.0-1, as modified by LR-ISG-2013-01. The staff's concern described in RAI B.1.45-3 is resolved.

The staff also noted that the applicant committed to implement the new Coating Integrity Program before September 20, 2024 or at the end of the last RFO before March 20, 2025;

however, initial inspections will be performed in the 10 years before March 30, 2025, for managing the effects of aging for applicable components.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's 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 exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the applicable aging effects. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 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 AMPs not consistent with or not addressed in the GALL Report, the staff performed a complete review to determine their adequacy to monitor or manage aging. The following sections document the staff's review of these plant-specific AMPs.

3.0.3.3.1 Periodic Surveillance and Preventive Maintenance

Summary of Technical Information in the Application. LRA Section B.1.35, as revised by letters dated July 30, 2014; January 15, 2015; and April 27, 2015, 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, elastomeric, and glass components exposed to various environments to manage the effects of loss of material due to corrosion and wear, fouling, and loss of sealing. The LRA also states that the AMP proposes to manage these aging effects through periodic visual inspections, physical manipulation (for rubber gaskets and seals), or other NDE methods. The LRA further states that the AMP manages loss of material of carbon steel components exposed to raw water for which plant-specific operating experience includes recurring internal corrosion.

Staff Evaluation. The staff reviewed program elements 1 through 6 of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these program elements follows. SER Section 3.0.4 documents the staff's review of the "corrective actions," "confirmation process," and "administrative controls" program elements.

Scope of Program. LRA Section B.1.35 states that the scope of the PSPM Program includes those specific SCs 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 noted that the program description of LRA Section B.1.35, as revised by letters dated July 30, 2014; January 15, 2015; and April 27, 2015, lists the system or structure and describes the components associated with each program activity. The staff also noted that the revisions to the PSPM Program procedures to include these activities were included as an enhancement to the program. The staff finds the applicant's "scope of program" program element to be adequate because it includes the specific SCs that the program manages.

Based on its review of the application, the staff confirmed that the "scope of program" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.1.35 states that the PSPM 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, for condition or performance monitoring programs that do not rely on preventive actions, this information need not be provided. The staff finds the applicant's "preventive actions" program element to be adequate because the PSPM Program is described as a condition monitoring program; therefore, preventive actions do not need to be described.

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; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.1.35, as revised by letter dated July 30, 2014, states that the PSPM Program identifies degradation by inspecting surface condition, flexibility (for elastomeric components), and wall thickness (for components subject to recurring internal corrosion).

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, for a condition monitoring program, the parameters monitored or inspected should be capable of detecting the presence and extent of aging effects.

The staff noted that the use of the parameter "surface condition" is consistent with the guidance for identifying loss of material in GALL Report AMP XI.M32, "One-Time Inspection," and is similarly capable of identifying component fouling. The staff also noted that monitoring surface condition and flexibility of components is capable of identifying elastomer degradation that may affect the ability of a seal to perform its function. The staff further noted that measurements of wall thickness are capable of identifying the presence and degree of loss of material due to recurring internal corrosion. The staff finds the applicant's "parameters monitored or inspected" program element to be adequate because, as described above, the use of the stated parameters is sufficient to identify loss of material, fouling, and loss of sealing before loss of intended functions of the component.

Based on its review of the application, the staff confirmed that the “parameters monitored or inspected” program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.1.35, as revised by letter dated July 30, 2014, states that the PSPM Program periodically inspects components at least once every 5 years to detect aging. The LRA also states that inspections are conducted by qualified personnel and focus on locations most susceptible to aging, where practical. The LRA further states that visual inspections are used to detect loss of material and fouling for metallic and glass-like components and that visual inspections and manual flexing are used to detect loss of sealing for elastomers. For activities involving sampling, a representative sample consists of 20 percent of the population (i.e., components having the same material, environment, and aging effect) up to a maximum of 25 components.

To address the recurring internal corrosion of carbon steel components exposed to raw water, the LRA states that periodic wall thickness measurements will be performed using ultrasonic thickness testing or other suitable techniques. The LRA also states that location selection will be based on pipe configuration, flow conditions, and operating history and that the locations will be periodically reviewed to validate their usefulness. In addition, as stated in the “monitoring and trending” program element, a minimum of five inspections will be performed each year until the occurrences of corrosion no longer meet the criteria for recurring internal corrosion (as defined in LR-ISG-2012-02 for the revised SRP-LR Section 3.3.2.2.8). To address the internal surfaces of buried piping subject to recurring corrosion, the LRA states that an inspection method will be selected from available technologies to provide a suitable indication of wall thickness for a representative sample of buried locations.

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 before a loss of component function and should describe all aspects of activities for data collection (e.g., inspection technique and frequency). 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 noted that portions of the program element described above are consistent with the guidance in the GALL Report for managing the aging of internal surfaces. For example, GALL Report AMP XI.M38 “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” includes visual inspections and physical manipulation (of elastomers), which are conducted at least once every 10 years on a representative sample of components.

The staff also noted that the portion of the program element associated with recurring internal corrosion is consistent with the guidance in the revision to SPR-LR Section 3.3.2.2.8 of LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation. LR-ISG-2012-02 states that, when a review of operating experience reveals recurring corrosion, augmented inspections should be considered that focus on sites based on aging susceptibility and consequences of failure. The staff also noted that the applicant’s proposal to inspect at least five locations every year would result in at least 50 inspections over a 10-year period for as long as the issue persists, which doubles the minimum number of inspections that are recommended in GALL Report AMP XI.M38, which manages internal surfaces.

The staff finds the applicant's "detection of aging effects" program element to be adequate because (1) the inspection techniques specified in the LRA for each activity in the program are capable of detecting the aging effect being managed, (2) the inspection sample size and frequency are comparable to other condition monitoring GALL Report AMPs that use sampling (and that are augmented as appropriate for recurring corrosion), (3) the component selection will focus on locations most susceptible to the aging effect, and (4) the inspections are performed by qualified personnel.

Based on its review of the application, the staff confirmed that the "detection of aging effects" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.1.35, as revised by letter dated July 30, 2012, states that the PSPM Program monitors and trends aging degradation and that inspection intervals are established to provide for timely detection of degradation. To address the recurring internal corrosion of carbon steel components exposed to raw water, the LRA states that wall thickness measurements will be compared to nominal wall thickness or previous measurements to determine rates of corrosion. Subsequent measurements will be performed as needed for each selected location based on rate of corrosion and expected time to reach the code minimum wall thickness plus margin for corrosion during the refueling cycle. In addition, as stated above, a minimum of five inspections will be performed each year until the occurrences of corrosion no longer meet the criteria for recurring internal corrosion.

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 inspection intervals are adjusted, as necessary, based on trending of wall thickness measurements to allow the detection of aging degradation before 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; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.1.35, as revised by letters dated July 30, 2014, and January 15, 2015, states that the PSPM Program acceptance criteria are defined in specific inspection procedures and that the criterion is no indication of relevant degradation (e.g., absence of excessive corrosion).

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 to allow the component intended functions to 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; 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," "monitoring and trending," 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.1.35 includes an enhancement to the "scope of program" program element. 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 program description. 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.1.35, as revised by letter dated July 30, 2014, includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that procedures will be revised to require periodic determination of wall thickness of selected components. The review of the "parameters monitored or inspected" program element documents the staff's review of this enhancement.

Enhancement 3. LRA Section B.1.35, as revised by letter dated July 30, 2014, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that procedures will be revised to require periodic wall thickness measurements using UT or other suitable techniques to identify loss of material due to recurring internal corrosion. The review of the "detection of aging effects" program element documents the staff's review of this enhancement.

Enhancement 4. LRA Section B.1.35, as revised by letter dated July 30, 2014, includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that procedures will be revised to require trending of wall thickness and use of that information to inform the extent of further inspections. The "monitoring and trending" program element documents the staff's review of this enhancement.

Enhancement 5. LRA Section B.1.35, as revised by letters dated July 30, 2014, and January 15, 2015, 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. The applicant also stated the revisions will include specific acceptance criteria for metallic and elastomeric components. The review of the "acceptance criteria" program element documents the staff's review of this enhancement.

In summary, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.35 summarizes operating experience related to the PSPM Program. The LRA states that an Institute of Nuclear Power Operations (INPO) assessment in 2011 led to improvements to the PM program, including using plant-specific templates for some PM activities and adopting a living PM program philosophy. The LRA also provided examples of activities that, according to the applicant, demonstrated the effectiveness of the PSPM Program. These examples include the use of visual inspections, eddy current testing, ultrasonic thickness testing to prompt plugging of heat exchanger tubes in the EDG system, and the use of periodic PMs to rate the condition of the combustion turbine generator.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that operating experience should be discussed. SRP-LR Section A.1.2.3.10 also states that this information should provide objective evidence to support the conclusion that the effects of aging will be adequately managed to maintain the SC intended function(s) during the period of extended operation.

During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program. Based on its review of the application, 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. The staff confirmed that the "operating experience" program element satisfies the criteria in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.1.35, as revised by letters dated July 30, 2014; January 15, 2015; and April 27, 2015, provides the UFSAR supplement for the PSPM Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The UFSAR 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 before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 QA Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), the applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation. SRP-LR Branch Technical Position (BTP) RLSB-1, "Aging Management Review – Generic," describes 10 elements of an acceptable AMP. Elements (7), (8), and (9) are associated with the QA activities of "corrective actions," "confirmation process," and "administrative controls." BTP RLSB-1 Table A.1-1, "Elements of an Aging Management Program for License Renewal," provides the following description of these three program elements:

(1) "corrective actions" – These actions, including root cause determination and prevention of recurrence, should be timely.

(2) "confirmation process" – This process should ensure that preventive actions are adequate and that appropriate corrective actions are completed and effective.

(3) "administrative controls" – These controls should provide for a formal review and approval process.

SRP-LR BTP IQMB-1, "Quality Assurance for Aging Management Programs," notes that AMP aspects that affect the quality of safety-related SSCs are subject to the QA requirements of Appendix B to 10 CFR Part 50. Additionally, for nonsafety-related SCs subject to an AMR, the applicant may use the existing QA program under Appendix B to 10 CFR Part 50 to address the elements of "corrective actions," "confirmation process," and "administrative controls." SRP-LR BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

- Safety-related SCs are subject to the requirements in Appendix B to 10 CFR Part 50, which are adequate to address all quality-related aspects of an AMP consistent with the CLB of the facility for the period of extended operation.
- For nonsafety-related SCs that are subject to an AMR, an applicant has an option to expand the scope of its QA program under Appendix B to 10 CFR Part 50 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 commitment in the UFSAR supplement in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

In LRA Appendix A, "Updated Final Safety Analysis Report Supplement," Section A.1, "Aging Management Programs," and LRA Appendix B, 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:

- Corrective actions for systems, structures and components are accomplished per the existing Fermi 2 Corrective Action Program and Fermi 2 procedures. The site Corrective Action Program and procedure control program apply to license renewal aging management activities for both safety-related and nonsafety-related structures and components.
- The confirmation process is part of the Corrective Action Program.
- Fermi 2 QA Program aspects related to procedure controls and administrative controls (document control requirements for procedures and manuals) and retention of records apply to Fermi 2 aging management activities associated with license renewal for both safety-related and nonsafety-related structures, systems, and components.

LRA Appendix B, Section B.0.3, states, in part:

- Corrective actions for systems, structures, and components are accomplished per the existing Fermi 2 Corrective Action Program and Fermi 2 procedures. The site Corrective Action Program and procedure control program apply to license renewal aging management activities for both safety-related and nonsafety-related structures and components.
- The confirmation process is part of the Corrective Action Program.
- The Fermi 2 QA Program aspects related to procedure controls and administrative controls (document control requirements for procedures and manuals) and retention of

records apply to Fermi aging management activities associated with license renewal for both safety-related and nonsafety-related structures, systems, and components. The Fermi 2 administrative controls are consistent with NUREG-1801.

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 BTP RLSB-1 describes 10 attributes of an acceptable AMP. Three of these 10 attributes are associated with the QA activities of corrective action, confirmation process, and administrative controls. BTP RLSB-1 Table A.1-1 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; and,
- Attribute No. 9 - Administrative Controls, which should provide a formal review and approval process.

SRP-LR BTP IQMB-1 states that those aspects of the AMP that affect the quality of SSCs are subject to the QA requirements of Appendix B to 10 CFR Part 50. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing QA program under Appendix B to 10 CFR Part 50 may be used to address the elements of corrective action, confirmation process, and administrative control. SRP-LR BTP IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

> Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements, which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The staff reviewed LRA Sections Appendix A, Section A.1, and Appendix B, Section B.0.3, which describe how the applicant’s existing QA program includes the QA-related elements (corrective action, confirmation process, and administrative controls) for AMPs consistent with the staff’s guidance described in SRP-LR BTP IQMB-1. The staff also reviewed a sample of AMP program basis documents and verified that the AMPs implement the corrective action program, confirmation processes, and administrative controls as described in the LRA. Based on its review, the staff determined that the quality 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 LRA Appendix A, Section A.1 LRA Appendix B, 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 BTP RLSB-1.

3.0.5 Operating Experience for Aging Management Programs

3.0.5.1 Summary of Technical Information in the Application

LRA Section B.0.4 describes the consideration of operating experience for AMPs. The LRA states that operating experience for the programs credited with managing the effects of aging are reviewed and include a review of corrective actions that resulted in program enhancements.

The applicant states that it 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 Final LR-ISG-2011-05, "Ongoing Review of Operating Experience," which includes interim revisions to the SRP-LR to clarify criteria for the "operating experience" program element. SER Section 3.0.3 discusses the staff's review of the second and third criteria, which concern currently available operating experience associated with existing and new programs, respectively. The following evaluation covers the staff's review of the first criterion, which concerns the consideration of future operating experience.

3.0.5.2.2 Consideration of Future Operating Experience

The staff reviewed LRA Sections B.0.4 and B.1 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 describes existing programs generally acceptable to the staff for the capture, processing, and evaluation of operating experience concerning age-related degradation and aging management during the term of a renewed operating license. The acceptable programs are those relied on to meet the requirements of Appendix B to 10 CFR Part 50 and Item I.C.5, "Procedures for Feedback of Operating Experience to Plant

Staff," in NUREG-0737, "Clarification of TMI Action Plan Requirements," dated November 1980. SRP-LR Section A.4.2 also states that, as part of meeting the requirements of NUREG-0737, Item I.C.5, the applicant's operating experience program should rely on active participation in the INPO operating experience program (formerly the INPO Significant Event Evaluation and Information Network (SEE IN) program endorsed in NRC GL 82-04, "Use of INPO SEE IN Program," dated March 9, 1982).

LRA Section B.0.4 states that the applicant uses its operating experience program to systematically capture and review operating experience from plant-specific and industry sources. The applicant stated that the operating experience program meets the requirements of NUREG-0737. The applicant further states that the operating experience program interfaces and relies on active participation in the INPO operating experience program. Based on this information, the staff determined that the applicant's operating experience program is consistent with the programs described in SRP-LR Section A.4.2.

3.0.5.2.4 Areas of Further Review

Application of Existing Programs and Procedures to the Processing of Operating Experience Related to Aging. SRP-LR Section A.4.2 states that the programs and procedures relied on to meet the requirements of Appendix B to 10 CFR Part 50 and NUREG-0737, Item I.C.5, should not preclude the consideration of operating experience on age-related degradation and aging management.

The applicant stated that operating experience from plant-specific and industry sources are systematically captured and reviewed on an ongoing basis in accordance with the 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 Section B.0.4 states 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 enhanced operating experience program would not preclude consideration of age-related operating experience, which is consistent with the guidance in SRP-LR Section A.4.2. In addition, SRP-LR Section A.4.2 states that the applicant should use the option described in SRP-LR Appendix A.2 to expand the scope of the QA program under Appendix B to 10 CFR Part 50 to include nonsafety-related SCs.

LRA Section B.0.3 states 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.

Consideration of Guidance Documents as Industry Operating Experience. RP-LR Section A.4.2 states that NRC and industry guidance documents and standards applicable to aging management, including revisions to the GALL Report, should be considered as sources of industry operating experience and evaluated accordingly.

LRA Section B.0.4 states that the sources of external operating experience include an active participation in the INPO operating experience program, GALL Report revisions, and other NRC guidance documents on aging management. The applicant also lists additional external sources, which include GALL Report revisions and other NRC guidance documents.

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 internal and external operating experience is captured and systematically reviewed on an ongoing basis.

LRA Section B.04 states that the operating experience program will be enhanced to provide for periodic evaluation of the effectiveness of their self-assessment process for each AMP described in the UFSAR supplement. 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 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 B.0.4 states that the operating experience program will be revised to add aging type codes to the corrective action program to describe 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 Section B.0.4 states that procedures will be revised to specify that the evaluations of operating experience concerning age-related degradation will include consideration of affected SSCs, environment, materials, aging effects, aging mechanisms, and AMPs. The staff determined that the applicant's evaluations of age-related operating experience will include the assessment of appropriate information to determine potential impacts to the aging management activities. The staff also determined that the applicant's operating experience program, in conjunction with the corrective action program, will implement any changes necessary to manage the effects of aging, as determined through its operating experience evaluations. Therefore, the staff finds that the information considered in the applicant's operating experience evaluations and use of the operating experience program and corrective action program to ensure that the effects of aging are adequately managed is consistent with the guidance in SRP-LR Section A.4.2.

<u>Evaluation of AMP Implementation Results</u>. 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.

<u>Training</u>. SRP-LR Section A.4.2 states that training on age-related degradation and aging management should be provided to those personnel responsible for implementing the AMPs and those personnel that may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience. SRP-LR Section A.4.2 also states that the training should be periodic and include provisions to accommodate the turnover of plant personnel.

LRA Section B.0.4 states that the operating experience program procedures will be revised to provide for 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 are consistent with the guidelines in SRP-LR Section A.4.2. The staff also determined that the applicant has demonstrated that its training program, when enhanced, will cover age-related degradation and aging management topics. The applicant's enhanced 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 this acceptable because the applicant will have 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. Fermi 2's UFSAR Section A.1 states that DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of this operating experience program described in the UFSAR supplement.

SRP-LR Section A.4.2 states that the operating experience review activities should be implemented on an ongoing basis throughout the term of a renewed license.

LRA Section B.0.4 states that the enhanced operating experience program will be implemented on an ongoing basis throughout the terms of the renewed licenses. In addition, LRA Section A.1 provides the UFSAR supplement summary description of the applicant's enhanced programmatic activities for ongoing review of the operating experience. On issuance of the renewed licenses in accordance with 10 CFR 54.3(c), this summary description will be incorporated into each plant's CLB, 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 enhanced operating experience review activities on an ongoing basis throughout the term of the renewed operating licenses.

3.0.5.2.5 Summary

Based on its review of the LRA the staff determined that the applicant's programmatic activities for the ongoing review of operating experience are acceptable for (a) the systematic review of plant-specific and industry operating experience to ensure that the license renewal AMPs are, and will continue to be, effective in managing the aging effects for which they are credited and (b) the enhancement of AMPs or development of new AMPs when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Based on the completion of the staff's review and the consistency of the applicant's operating experience review activities with the guidance in LR-ISG-2011-05, the staff finds the applicant's programmatic activities for the ongoing review of operating experience acceptable.

3.0.5.3 UFSAR Supplement

In accordance with 10 CFR 54.21(d), the UFSAR supplement must contain a summary description of the programs and activities for managing the effects of aging. LRA Section A.1 provides the UFSAR supplement summary description of the applicant's programmatic activities for the ongoing review of operating experience. It also identifies enhancements that will be implemented to 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 also sufficiently comprehensive to describe the applicant's programmatic activities for evaluating operating experience to maintain the effectiveness of the AMPs. Therefore, the staff finds the applicant's UFSAR supplement summary description acceptable.

3.0.5.4 Conclusion

Based on its review of the applicant's programmatic activities for the ongoing review of operating experience, the staff concludes that the applicant has demonstrated that operating experience will be reviewed to ensure that the effects of aging will be adequately managed so that the intended 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 UFSAR supplement for these activities and concludes that it provides an adequate summary description, as required by 10 CFR 54.21(d).

3.1 Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the reactor vessel, reactor vessel internals, and reactor coolant system (RCS) components and component groups of the following:

- reactor vessel
- reactor vessel internals
- reactor coolant pressure boundary
- miscellaneous 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, reactor vessel internals, and reactor coolant system components and component groups. LRA Table 3.1.1, "Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the reactor vessel, reactor vessel internals, and RCS components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the reactor vessel, reactor vessel internals, and RCS components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of the applicant's AMRs to confirm the applicant's claim that certain AMRs are consistent with the GALL Report, not applicable, or not used. 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. The AMRs that the staff confirmed are consistent with the GALL Report are noted as such in SER Table 3.1-1 and no further discussion is required. The AMRs that the staff confirmed are not applicable to Fermi 2 or not used, because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another SER Table 3.1-1 item, or that require no aging management are noted in SER Table 3.1-1 and are discussed in SER Section 3.1.2.1.1, "AMR Results Identified as Not Applicable or Not Used." Details of the staff's evaluation of AMRs that the applicant claimed are consistent with the GALL Report, but for which a different AMP from the program recommended in the GALL Report is used to manage aging, and AMRs for which the staff requested additional information are documented in SER Sections 3.1.2.1.2 through 3.1.2.1.4.

During its review, the staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.1.2.2 acceptance criteria. The staff's evaluations of AMRs for which the GALL Report recommends further evaluation are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations of AMRs not consistent with, or not addressed in, the GALL Report are documented in SER Section 3.1.2.3.

SER 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	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	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.1)
Stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux (3.1.1-3)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Steel pressure vessel support skirt and attachment welds (3.1.1-4)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
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	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor coolant pressure boundary components: piping, piping components, and piping elements exposed to reactor coolant (3.1.1-6)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant (3.1.1-7)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy steam generator components exposed to reactor coolant (3.1.1-8)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without nickel-alloy or stainless steel cladding), stainless steel; nickel alloy RCPB piping; flanges; nozzles & safe ends; pressurizer shell heads & welds; heater sheaths & sleeves; penetrations; thermal sleeves exposed to reactor coolant (3.1.1-9)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), stainless steel; nickel alloy reactor vessel flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant (3.1.1-10)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.1)
Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles (3.1.1-11)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation; check ASME Code limits for allowable cycles (less than 7,000 cycles) of thermal stress range (see SRP Section 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel steam generator components: upper and lower shells, transition cone; new transition cone closure weld exposed to secondary feedwater or steam (3.1.1-12)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” and Chapter XI.M2, “Water Chemistry,” and, for Westinghouse Model 44 and 51 S/G, if corrosion of the shell is found, additional inspection procedures are developed	Yes, detection of aging effects is to be evaluated	Not applicable	Not applicable to BWRs (see SER Sections 3.1.2.2.2(1) and 3.1.2.2.2(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	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.3(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, plant-specific or integrated surveillance program	Reactor Vessel Surveillance Program	Consistent with the GALL Report (see SER Section 3.1.2.2.3(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 SRP, Section 4.7, “Other Plant-Specific TLAAs,” for acceptable methods of meeting the requirements of 10 CFR 54.21(c)).	Yes, TLAA	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.3(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, plant-specific	One-Time Inspection and Water Chemistry Control – BWR programs	Consistent with the GALL Report (see SER Section 3.1.2.2.4(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, detection of aging effects is to be evaluated	Not used. Fermi 2 does not have an isolation condenser.	Not applicable to Fermi 2 (see SER Section 3.1.2.2.4(2))
Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process 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. 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, TLAA	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.5)
Stainless steel reactor vessel closure head flange leak-detection line and bottom-mounted instrument guide tubes (external to reactor vessel) (3.1.1-19)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.6(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	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.2.6(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, detection of aging effects is to be evaluated	Not used. Fermi 2 does not have an isolation condenser.	Not applicable to Fermi 2 (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	Not applicable to BWRs (see SER Section 3.1.2.2.8)
SRP-LR Item No. (3.1.1-23) Deleted by LR-ISG-2011-04	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable (see SER Section 3.1.2.2.9)
SRP-LR Item No. (3.1.1-24) Deleted by LR-ISG-2011-04	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable (see SER Section 3.1.2.2.10)
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	Not applicable	Not applicable to BWRs (see SER Sections 3.1.2.2.11(1) and 3.1.2.2.11(2))
SRP-LR Item No. (3.1.1-26) Deleted by LR-ISG-2011-04	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable (see SER Section 3.1.2.2.12)
SRP-LR Item No. (3.1.1-27) Deleted by LR-ISG-2011-04	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable (see SER Section 3.1.2.2.13)
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	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant (3.1.1-29)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry," and for BWRs with a crevice in the access hole covers, augmented inspection using UT or other acceptable techniques	No	Inservice Inspection and Water Chemistry Control – BWR programs	Consistent with the GALL Report
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 used. The Fermi 2 vessel does not have a stainless steel or nickel alloy drain penetration.	Not applicable to BWRs (see SER Section 3.1.2.1.1)
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 used. Fermi 2 does not have an isolation condenser.	Not applicable to Fermi 2 (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 applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, steel with stainless steel cladding Class 1 reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-33)	Cracking due to stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for ASME components, and Chapter XI.M2, "Water Chemistry"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel with stainless steel cladding pressurizer relief tank (tank shell and heads, flanges, nozzles) exposed to treated borated water >60°C (>140°F) (3.1.1-34)	Cracking due to stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for ASME components, and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, steel with stainless steel cladding reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant (3.1.1-35)	Cracking due to cyclic loading	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel, stainless steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F) (3.1.1-36)	Cracking due to cyclic loading	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel reactor vessel flange (3.1.1-37)	Loss of material due to wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250 °C (>482 °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 Program	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 – BWR, and One-Time Inspection – Small-Bore Piping programs	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	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy core support pads; core guide lugs exposed to reactor coolant (3.1.1-40.5)	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	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy core shroud and core plate access hole cover (mechanical covers) exposed to reactor coolant (3.1.1-41)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry”	No	Not used. The shroud support access hole covers are welded.	Not applicable to Fermi 2 (see SER Section 3.1.2.1.1)
Steel with stainless steel or nickel alloy cladding or stainless steel primary side components; steam generator upper and lower heads, and tube sheet weld; or pressurizer components exposed to reactor coolant (3.1.1-42)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant (3.1.1-43)	Loss of material due to pitting and crevice corrosion	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry”	No	Water Chemistry Control – BWR, One-Time Inspection, and Inservice Inspection programs.	Consistent with the GALL Report (see SER Section 3.1.2.1.2)
Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam (3.1.1-44)	Loss of material due to erosion	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 2 components	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy and steel with nickel-alloy cladding reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-45)	Cracking due to primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI ISI, IWB, IWC & IWD,” and Chapter XI.M2, “Water Chemistry,” and, for nickel-alloy, Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in RCPB Components (PWRs Only)”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, nickel-alloy, nickel-alloy welds and/or buttering control rod drive head penetration pressure housing or nozzles safe ends and welds (inlet, outlet, safety injection) exposed to reactor coolant (3.1.1-46)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI ISI, IWB, IWC & IWD,” and Chapter XI.M2, “Water Chemistry,” and, for nickel-alloy, Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced corrosion in RCPB Components (PWRs Only)”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, nickel-alloy control rod drive head penetration pressure housing exposed to reactor coolant (3.1.1-47)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI ISI, IWB, IWC & IWD,” and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel external surfaces: reactor vessel top head, reactor vessel bottom head, reactor coolant pressure boundary piping or components adjacent to dissimilar metal (Alloy 82/182) welds exposed to air with borated water leakage (3.1.1-48)	Loss of material due to boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion,” and Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in RCPB Components (PWRs Only)”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel reactor coolant pressure boundary external surfaces or closure bolting exposed to air with borated water leakage (3.1.1-49)	Loss of material due to boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250 °C (>482 °F) (3.1.1-50)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	Not used. The Inservice Inspection Program manages the reduction of fracture toughness in cast austenitic stainless steel pump casings and valve bodies in the reactor coolant pressure boundary (see item 3.1.1-38). There are no other Class 1 CASS components in the reactor coolant system pressure boundary. The main steam line flow elements (flow restrictors) and recirculation loop flow elements are not Class 1 components (elements are completely internal to the carbon steel pipe). The CASS subcomponents of the flow elements are not susceptible to thermal aging embrittlement because they are composed of low-molybdenum CASS (DF8) and were centrifugally cast.	Not applicable to Fermi 2 (see SER Section 3.1.2.1.1)
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	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or nickel alloy 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	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Combustion Engineering reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-52a)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Combustion Engineering reactor internal “Expansion” components exposed to reactor coolant and neutron flux (3.1.1-52b)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Combustion Engineering reactor internal “Existing Programs” components exposed to reactor coolant and neutron flux (3.1.1-52c)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Westinghouse reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-53a)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
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	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or nickel alloy 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	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel bottom mounted instrument system flux thimble tubes (with or without chrome plating) exposed to reactor coolant and neutron flux (Westinghouse “Existing Programs” components) (3.1.1-54)	Loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals,” or Chapter XI.M37, “Flux Thimble Tube Inspection”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Babcock & Wilcox reactor internal “No Additional Measures” components exposed to reactor coolant and neutron flux (3.1.1-55a)	No additional aging management for reactor internal “No Additional Measures” components unless required by ASME Section XI, Examination Category B-N-3 or relevant operating experience invalidates MRP-227-A.	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
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 invalidates MRP-227-A.	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or nickel alloy 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 invalidates MRP-227-A.	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Combustion Engineering reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-56a)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) Combustion Engineering "Expansion" reactor internal components exposed to reactor coolant and neutron flux (3.1.1-56b)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Combustion Engineering reactor internal "Existing Programs" components exposed to reactor coolant and neutron flux (3.1.1-56c)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
The SRP-LR, as amended by ISGs, does not list an Item No. (3.1.1-57)	Not applicable	Not applicable	Not applicable	Not applicable	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 (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	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Babcock & Wilcox reactor internal “Expansion” components exposed to reactor coolant and neutron flux (3.1.1-58b)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Westinghouse reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-59a)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) Westinghouse reactor internal “Expansion” components exposed to reactor coolant and neutron flux (3.1.1-59b)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Westinghouse reactor internal "Existing Programs" components exposed to reactor coolant and neutron flux (3.1.1-59c)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-60)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion Program	Consistent with the GALL Report
Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam (3.1.1-61)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage (3.1.1-62)	Cracking due to stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel or stainless steel closure bolting exposed to air with reactor coolant leakage (3.1.1-63)	Loss of material due to general (steel only), pitting, and crevice corrosion or wear	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel closure bolting exposed to air – indoor uncontrolled (3.1.1-64)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage (3.1.1-65)	Loss of material due to wear	Chapter XI.M18, "Bolting Integrity"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage (3.1.1-66)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage (3.1.1-67)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity Program	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	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam (3.1.1-69)	Cracking due to outer diameter stress corrosion cracking and intergranular attack	Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-70)	Cracking due to primary water stress corrosion cracking	Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti-vibration bars exposed to secondary feedwater or steam (3.1.1-71)	Cracking due to stress corrosion cracking or other mechanism(s); loss of material due general (steel only), pitting, and crevice corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator tube support plate, tube bundle wrapper, supports, and mounting hardware exposed to secondary feedwater or steam (3.1.1-72)	Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater or steam (3.1.1-73)	Loss of material due to wastage and pitting corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator upper assembly and separators including feedwater inlet ring and support exposed to secondary feedwater or steam (3.1.1-74)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator tube support lattice bars exposed to secondary feedwater or steam (3.1.1-75)	Wall thinning due to flow-accelerated corrosion and general corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti-vibration bars exposed to secondary feedwater or steam (3.1.1-76)	Loss of material due to fretting	Chapter XI.M19, “Steam Generators”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam (3.1.1-77)	Loss of material due to wear and fretting	Chapter XI.M19, “Steam Generators”	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy steam generator components such as secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater or steam (3.1.1-78)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection," or Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-79)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report
Stainless steel or steel with stainless steel cladding pressurizer relief tank: tank shell and heads, flanges, nozzles (none-ASME Section XI components) exposed to treated borated water >60°C (>140°F) (3.1.1-80)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel pressurizer spray head exposed to reactor coolant (3.1.1-81)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy pressurizer spray head exposed to reactor coolant (3.1.1-82)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator shell assembly exposed to secondary feedwater or steam (3.1.1-83)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant (3.1.1-84)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds exposed to reactor coolant (3.1.1-85)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-86)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel-alloy PWR reactor internal components exposed to reactor coolant and neutron flux (3.1.1-87)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry"	No	Not used	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-88)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-89)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Copper-alloy piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-90)	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1
High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage (3.1.1-91)	Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (BWR)	Chapter XI.M3, "Reactor Head Closure Stud Bolting"	No	Reactor Head Closure Studs Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage (3.1.1-92)	Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (PWR)	Chapter XI.M3, "Reactor Head Closure Stud Bolting"	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Copper alloy >15% Zn or > 8% Al piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-93)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching "	No	Not applicable	Not applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-94)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M4, "BWR Vessel ID Attachment Welds," and Chapter XI.M2, "Water Chemistry"	No	BWR Vessel ID Attachment Welds and Water Chemistry Control – BWR programs	Consistent with the GALL Report
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-95)	Cracking due to cyclic loading	Chapter XI.M5, "BWR Feedwater Nozzle"	No	BWR Feedwater Nozzle Program	Consistent with the GALL Report
Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant (3.1.1-96)	Cracking due to cyclic loading	Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle"	No	Not used. The Fermi 2 control rod drive return line was cut and capped before initial plant operation. The nozzles have not been exposed to thermal cyclic loading form operation of the return line.	Not applicable to Fermi 2 (see SER Section 3.1.2.1.1)
Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 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	Either BWR Stress Corrosion Cracking Program, Inservice Inspection Program, or BWR CRD Return Line Nozzle Program; and Water Chemistry Control – BWR Program.	Consistent with the GALL Report (see SER Section 3.1.2.1.3)

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 or nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant (3.1.1-98)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M8, "BWR Penetrations," and Chapter XI.M2, "Water Chemistry"	No	BWR Penetrations and Water Chemistry Control – BWR programs	Consistent with the GALL Report
Cast austenitic stainless steel; PH martensitic stainless steel; martensitic stainless steel; X-750 alloy reactor internal components exposed to reactor coolant and neutron flux (3.1.1-99)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Chapter XI.M9, "BWR Vessel Internals"	No	BWR Vessel Internals Program	Consistent with the GALL Report
Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant (3.1.1-100)	Loss of material due to wear	Chapter XI.M9, "BWR Vessel Internals"	No	BWR Vessel Internals Program	Consistent with the GALL Report
Stainless steel steam dryers exposed to reactor coolant (3.1.1-101)	Cracking due to flow-induced vibration	Chapter XI.M9, "BWR Vessel Internals" for steam dryer	No	BWR Vessel Internals Program	Consistent with the GALL Report
Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant (3.1.1-102)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"	No	BWR Vessel Internals and Water Chemistry Control – BWR programs	Consistent with the GALL Report
Stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux (3.1.1-103)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"	No	BWR Vessel Internals, Water Chemistry Control – BWR, and Inservice Inspection programs	Consistent with the GALL Report (see SER Section 3.1.2.1.4)
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 used. The Fermi 2 vessel internals do not have X-750 alloy core plate components.	Not applicable to Fermi 2 (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 piping, piping components, and piping element exposed to concrete (3.1.1-105)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not used. No steel reactor coolant pressure boundary piping components are embedded in concrete.	Not applicable to Fermi 2 (see SER Section 3.1.2.1.1)
Nickel alloy piping, piping components, and piping element exposed to air – indoor, uncontrolled, or air with borated water leakage (3.1.1-106)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801, “Generic Aging Lessons Learned (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	NA – No AEM or AMP	Consistent with NUREG-1801, “Generic Aging Lessons Learned (GALL) Report”	Consistent with the GALL Report
The SRP-LR, as amended by ISGs, does not list an Item No. (3.1.1-108)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
The SRP-LR, as amended by ISGs, does not list an Item No. (3.1.1-109)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
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 used. Based on plant operating experience, components of the RCS are not susceptible to erosion.	Not applicable to Fermi 2 (see SER Section 3.1.2.1.1)

3.1.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.1.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the reactor vessel, reactor internals, and reactor coolant system components:

- Bolting Integrity
- BWR CRD Return Line Nozzle
- BWR Feedwater Nozzle
- BWR Penetrations
- BWR Stress Corrosion Cracking
- BWR Vessel ID Attachment Welds
- BWR Vessel Internals
- Compressed Air Monitoring
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Inservice Inspection
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- One-Time Inspection – Small-Bore Piping
- Periodic Surveillance and Preventive Maintenance
- Reactor Head Closure Studs
- Reactor Vessel Surveillance
- Selective Leaching
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

LRA Tables 3.1.2-1 through 3.1.2-4-3 summarize AMRs for the reactor vessel, reactor vessel internals, and RCS 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 of 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 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 reviewed the information in the LRA. 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 follows.

3.1.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.1.1, items 3.1.1-28, 3.1.1-30, 3.1.1-32, 3.1.1-33, 3.1.1-34, 3.1.1-35, 3.1.1-36, 3.1.1-37, 3.1.1-40, 3.1.1-40.5, 3.1.1-42, 3.1.1-44, 3.1.1-45, 3.1.1-46, 3.1.1-47, 3.1.1-48, 3.1.1-49, 3.1.1-51a, 3.1.1-51b, 3.1.1-52a, 3.1.1-52b, 3.1.1-52c, 3.1.1-53a, 3.1.1-53b, 3.1.1-53c, 3.1.1-54, 3.1.1-55a, 3.1.1-55b, 3.1.1-55c, 3.1.1-56a, 3.1.1-56b, 3.1.1-56c, 3.1.1-58a, 3.1.1-58b, 3.1.1-59a, 3.1.1-59b, 3.1.1-59c, 3.1.1-61, 3.1.1-62, 3.1.1-64, 3.1.1-65, 3.1.1-66, 3.1.1-68, 3.1.1-69, 3.1.1-70, 3.1.1-71, 3.1.1-72, 3.1.1-73, 3.1.1-74, 3.1.1-75, 3.1.1-76, 3.1.1-77, 3.1.1-78, 3.1.1-80, 3.1.1-81,3.1.1-82, 3.1.1-83, 3.1.1-86, 3.1.1-87, 3.1.1-88, 3.1.1-89, 3.1.1-90, 3.1.1-92, and 3.1.1-93, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to pressurized water reactors (PWRs). The staff reviewed the SRP-LR; confirmed these items only apply to PWRs; and finds that these items are not applicable to Fermi 2, which is a BWR.

For LRA Table 3.1.1, items 3.1.1-31, and 3.1.1-50, the applicant claimed that the corresponding items in the GALL Report are not applicable or are not used because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another Table 1 item. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items or that the aging effects addressed by other Table 1 AMR line items are appropriate.

LRA Table 3.1.1, item 3.1.1-41, addresses nickel alloy core shroud and core plate access hole mechanical covers; the applicant's design uses a welded cover that is represented by LRA Table 1 AMR item 3.1.1-29; therefore, item 3.1.1-41 is not applicable to Fermi 2.

LRA Table 3.1.1, item 3.1.1-104, addresses X-750 alloy reactor vessel internal components exposed to reactor coolant and neutron flux. The GALL Report recommends GALL Report AMP XI.M9, "BWR Vessel Internals" for the core plate and GALL Report AMP XI.M2, "Water Chemistry" to manage cracking due to IGSCC for this component group. The applicant stated that this item is not used because Fermi 2 does not have X-750 alloy core plate components. The staff noted that LRA Table 3.1.2-2 contains reactor vessel internal components exposed to reactor coolant and neutron flux, such as certain jet pump assembly components. The staff noted that the applicant cited LRA Table 3.1.1, item 3.1.1-103, for these components. The staff evaluated the applicant's claim and finds it acceptable because the applicant is using a more conservative LRA Table 3.1.1 line item to manage cracking of nickel alloy reactor vessel internal components, including those made from nickel alloy X-750 materials. LRA Table 3.1.1, item 3.1.1-103, is also being used to manage cracking in those reactor vessel internal components made from stainless steel materials. Therefore, it is acceptable to use LRA Table 3.1.1, item 3.1.1-103, in lieu of LRA Table 3.1.1, item 3.1.1-104.

For LRA Table 3.1.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable or are not used. However, the staff had to review sources beyond the LRA and UFSAR or to issue one or more RAIs, or both, in order to verify the applicant's claim.

LRA Table 3.1.1, item 3.1.1-96, addresses steel, with or without stainless steel cladding, CRD return line nozzles exposed to reactor coolant. The GALL Report recommends GALL Report AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle," to manage cracking due to cyclic loading for this component group. The applicant stated that this item is not applicable because the CRD return line was cut and capped before initial plant operation; therefore, the CRD return line nozzle has not been exposed to cyclic loading as a result of CRD return line operation.

The staff evaluated the applicant's claim that this item is not used. LRA Section B.1.5 states that the existing BWR CRD Return Line Nozzle Program is consistent with GALL Report AMP XI.M6; therefore, the scope of the BWR CRD Return Line Nozzle Program includes the CRD return line nozzle and its associated nozzle-to-vessel weld. However, given that the applicant did not use LRA Table 3.1.1, item 3.1.1-96, and the absence of other line items for these components in the LRA, the staff determined that the applicant had not sufficiently 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 for the period of extended operation, as required by 10 CFR 54.21(a)(3).

By letter dated December 23, 2014, the staff issued RAI 3.1.2.1-1 requesting that the applicant provide the AMR results for the CRD return line nozzle and its nozzle-to-vessel weld if these components are within the scope of the BWR CRD Return Line Nozzle Program. The staff also requested that the applicant describe how these AMR results compare with SRP-LR Table 3.1-1, item 96. If the CRD return line nozzle and its nozzle-to-vessel weld are not within the scope of the BWR CRD Return Line Nozzle Program, the staff requested that the applicant explain why LRA Section B.1.5 does not identify an exception to the "scope of program" program element of GALL Report AMP XI.M6.

In its response dated January 26, 2015, the applicant stated that all the components included in LRA Section B.1.5 were not identified as line items in LRA Table 3.1.2-1 for the CRD return line nozzle (N9). The applicant also stated that the CRD Return Line Nozzle Program includes the CRD return line nozzle, its nozzle-to-reactor-vessel weld, CRD return line nozzle Inconel cap, and cap-to-nozzle Inconel weld. The applicant further stated that it will revise LRA Table 3.1.2-1 to include line items for the nozzle with the aging effect of cracking and for the nozzle weld with the aging effect of cracking and loss of material. The applicant further stated that Table 3.1.1, item 96, will be revised to indicate that the CRD Return Line Nozzle Program manages cracking for the nozzle, cap, and the associated welds. The applicant cited generic note I, for the components associated with LRA Table 3.1.1, item 3.1.1-96, and the CRD return line nozzle.

Plant-specific note I states that the aging effect identified in GALL Report for this component, material, and environment combination is not applicable. The applicant stated that because the CRD return line was cut and capped before initial operation, the nozzle has not been thermally cycled due to operation of the return line. The applicant also stated that cracking due to cyclic loading is not applicable to its CRD return line nozzle.

The staff finds the applicant's response related to item 3.1.1-96 acceptable because the staff verified that the applicant's CRD return line was capped before initial operations; therefore, the applicant's determination that the CRD return line nozzle is not subject to cyclic loading is justified. In addition, the applicant addressed the applicable aging effects for the components associated with the CRD return line by revising LRA Table 3.1.1, item 3.1.1-97, as discussed below.

The applicant stated that, because the material for the weld and the cap are nickel alloy, it will use Table 3.1.1, item 3.1.1-97, for these components. The applicant cited generic note E for item 3.1.1-97 and the associated CRD return line nickel alloy components. Plant-specific note E states that the material, environment, and aging effect identified is consistent with the GALL Report for this material and environment combination; however, a different AMP is credited. The applicant also stated that the BWR CRD Return Line Nozzle and Water Chemistry Control – BWR programs are credited to manage cracking due to SCC for the nickel alloy welds for this component. As a result, the applicant revised LRA Tables 2.3.1-1, 3.1.1, and 3.1.2-1, consistent with its response.

The staff's evaluations of the applicant's BWR CRD Return Line Nozzle and Water Chemistry Control – BWR programs are documented in SER Sections 3.0.3.1.3 and 3.0.3.1.20, respectively. The staff noted that the BWR CRD Return Line Nozzle Program uses volumetric examinations which can detect SCC, whereas the Water Chemistry Control – BWR Program limits the concentrations of contaminants (e.g., chlorides and sulfates) known to cause SCC. Therefore, the staff finds the applicant's proposal acceptable. In addition, the applicant clarified that all the components associated with the applicant's CRD return line, nozzle, cap, and associated welds will be age managed by the applicant's CRD Return Line Nozzle Program, consistent with the guidance provided in the GALL Report. Based on its review of the components associated with item 3.1.1-97 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage aging using the BWR CRD Return Line Nozzle Program and Water Chemistry Control – BWR programs acceptable. The staff's concern described in RAI 3.1.2.1-1 is resolved.

By letter dated May 9, 2016, the applicant provided an annual update to the LRA. The annual update states that a more detailed review of the CRD return line welds has indicated that the nozzle-to-cap weld is nickel alloy but the nozzle-to-vessel weld is carbon steel. In its update, the applicant revised LRA Table 3.1.1, item 3.1.1-96 and Table 3.1.2-1 to indicate that the two welds are different materials. In its revision, the applicant also indicated that cracking due to cyclic loading of the carbon steel nozzle-to-vessel weld will be managed by using LRA Table 3.1.1, item 3.1.1-96 and BWR CRD Return Line Nozzle Program, consistent with the aging management for the CRD return line nozzle that is also fabricated of carbon steel. In its review, the staff finds the applicant's update acceptable because it provides a correction to the material of fabrication for the nozzle-to-vessel weld and the BWR CRD Return Line Nozzle Program, which includes volumetric examination, is sufficient to detect and manage cracking for CRD return line components for the period of extended operation.

The staff concludes that for LRA item 3.1.1-97 and the components associated with the CRD return line, 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 3.1.1-105, addresses steel piping, piping components, and piping elements exposed to concrete. The GALL Report recommends no AERM or AMP if certain concrete attributes and plant-specific operating experience are met for this component group. The applicant stated that this item is not used because there are no steel RCPB piping components exposed to concrete. However, in reference to small-bore field run RCPB piping, UFSAR Section 5.2.1.19 states that "[h]ydrostatic testing, prior to erection, is required for any pipe spool that is embedded in concrete or installed in an inaccessible location." Although the UFSAR does not state that steel piping is embedded in concrete, it was not clear to the staff whether an oversight had occurred during the development of the LRA. By letter dated December 19, 2014, the staff issued RAI 3.1.2.1.1-1 requesting that the applicant reconcile the statement associated with LRA Table 3.1.1, item 3.1.1-105, with UFSAR Section 5.2.1.19 and, if the RCPB is embedded in concrete, state how it will manage the applicable aging effects or provide the basis for why there are no aging effects.

In its response dated January 28, 2015, the applicant stated that there is no RCPB piping embedded in concrete. The applicant also stated that the UFSAR statement is a general specification.

The staff finds the applicant's response acceptable because the applicant confirmed that none of its RCPB piping is embedded in concrete; therefore, it is appropriate to cite LRA Table 3.1.1, item 3.1.1-105, as not used. The staff's concern described in RAI 3.1.2.1.1-1 is resolved.

LRA Table 3.1.1, item 3.1.1-110, addresses piping, piping components, and piping elements made from any material exposed to reactor coolant. The GALL Report recommends AMP XI.M17, "Flow-Accelerated Corrosion" to manage wall thinning due to erosion for this component group. The LRA states that this item was not used because, based on plant operating experience, components within the RCS are not susceptible to erosion. 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 also did not identify any issues due to erosion within the RCS during its independent search of the plant operating experience information.

3.1.2.1.2 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.1.1, item 3.1.1-43, addresses stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant, which will be managed for loss of material due to pitting and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the Water Chemistry Control – BWR Program to manage the aging effect. The AMR items cite plant-specific note 101, which states that the effectiveness of the Water Chemistry Control – BWR Program will be verified using the One-Time Inspection Program. The GALL Report recommends GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, IWB, IWC, and IWD," and GALL Report AMP XI.M2, "Water Chemistry," to ensure that this aging effect is adequately managed.

GALL Report AMP XI.M1 recommends using periodic visual, surface, and/or volumetric examination and leakage testing along with GALL Report AMP XI.M2, which recommends monitoring and controlling known detrimental contaminants in accordance with the recommendations of BWRVIP-190 to manage the aging of this line item. The One-Time Inspection Program, consistent with GALL Report AMP XI.M32, "One-Time Inspection," is substituted for GALL Report AMP XI.M1. The One-Time Inspection Program is used to (a) verify the effectiveness of the Water Chemistry Control – BWR Program by confirming that unacceptable loss of material is not occurring with visual and/or equivalent volumetric examination and (b) provide additional actions to maintain the intended functions of applicable components throughout the period of extended operation.

The staff's evaluation of the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.20 and 3.0.3.1.17, respectively.

Based on its review of components associated with item 3.1.1-43, for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Water Chemistry Control – BWR Program and One-Time Inspection Program acceptable because (a) the applicant's use of the Water Chemistry Control – BWR Program will ensure that the environment will not be conducive for loss of material to occur and is consistent with the recommendations in the GALL Report and (b) the One-Time Inspection Program will provide visual and/or equivalent volumetric examination to verify that unacceptable loss of material is not occurring and may trigger additional actions that ensure that the intended functions of the affected components are maintained throughout the period of extended operation.

The staff concludes that, for LRA item 3.1.1-43, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.1.2.1.3 Cracking Due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking (IGSCC)

LRA Table 3.1.1, item 3.1.1-97 addresses stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS and reactor vessel nozzle safe ends and associated welds exposed to reactor coolant, which will be managed for cracking due to SCC (including IGSCC). The GALL Report recommends GALL Report AMP XI.M7, "BWR Stress Corrosion Cracking," and GALL Report AMP XI.M2, "Water Chemistry" to ensure that the aging effect is adequately managed for these components. GALL Report AMP XI.M7 conducts volumetric examination on BWR piping and piping welds to detect and manage cracking due to IGSCC. GALL Report AMP XI.M2 performs water chemistry control to manage aging by limiting the concentrations of chemical species known to cause cracking due to SCC.

The applicant cited generic note E for the nickel alloy CRD return line cap. The applicant also stated that the BWR CRD Return Line Nozzle Program and Water Chemistry Control – BWR Program are credited to manage cracking due to SCC for this component.

The staff's evaluations of the applicant's BWR CRD Return Line Nozzle Program and Water Chemistry Control – BWR Program are documented in SER Sections 3.0.3.1.3 and 3.0.3.1.20, respectively. In addition, the staff's evaluation of LRA Table 3.1.1, item 3.1.1-97 as it relates to CRD return line nickel alloy components is documented in SER Section 3.1.2.1.1.

The applicant also cited generic note E for the following components, which are managed by the Inservice Inspection Program and Water Chemistry Control – BWR Program: (a) reactor vessel beltline shell rings and nonbeltline components (i.e., nonbeltline top head and closure flange, shell rings and closure flange, and bottom head) made of carbon steel clad with stainless steel, (b) thermowell, orifice, and reactor recirculating pump cooler assembly made of stainless steel, and (c) valve bodies less than 4 inch NPS made of stainless steel or cast austenitic stainless steel.

The staff's evaluations of the applicant's Inservice Inspection Program and Water Chemistry Control – BWR Program are documented in SER Sections 3.0.3.1.10 and 3.0.3.1.20, respectively. The staff noted that the Inservice Inspection Program proposes to manage the effects of aging for these components through the use of volumetric, surface, and visual examinations. The staff also noted that the Water Chemistry Control – BWR Program proposes to manage the effects of aging for these components through the use of water chemistry control. Based on its review of these components associated with item 3.1.1-97, for which the applicant cited generic note E, the staff finds the applicant's proposal to manage aging using the Inservice Inspection Program and Water Chemistry Control – BWR Program acceptable because the Inservice Inspection Program uses NDEs in accordance with the ASME Code requirements and 10 CFR 50.55a, which can detect and manage SCC, and the Water Chemistry Control – BWR Program limits the concentrations of chemical species known to cause SCC to minimize the environmental effect on SCC.

By letter dated January 5, 2015, the applicant revised LRA Tables 3.4.2-2 and 3.4.2-3-2 to include AMR items that manage cracking due to SCC for feedwater heater nozzle-to-safe-end and safe-end-to-pipe welds made of stainless steel and nickel alloy, as documented in SER Section 3.0.3.1.6. The applicant indicated that these welds are GL 88-01 Category D welds in the feedwater and condensate systems. The applicant also stated that these AMR items are associated with LRA item 3.1.1-97, and generic note D is cited for these welds. In addition, the applicant stated that cracking due to SCC will be managed by using the BWR Stress Corrosion Cracking Program and Water Chemistry Control – BWR Program. The staff finds the applicant's revisions to LRA Tables 3.4.2-2 and 3.4.2-3-2 acceptable, as documented in Section 3.0.3.1.6.

The staff's evaluations of the applicant's BWR Stress Corrosion Cracking Program and Water Chemistry Control – BWR Program are documented in SER Sections 3.0.3.1.6 and 3.0.3.1.20, respectively. The staff noted that the BWR Stress Corrosion Cracking Program proposes to manage the effects of aging for these components through the use of volumetric examinations. As discussed above, the staff noted that the Water Chemistry Control – BWR Program proposes to manage the effects of aging for these components through the use of water chemistry control. Based on its review of these components associated with item 3.1.1-97, for which the applicant cited generic note D, the staff finds the applicant's proposal to manage aging using the BWR Stress Corrosion Cracking Program and Water Chemistry Control – BWR Program acceptable because the BWR Stress Corrosion Cracking Program performs periodic volumetric examinations, which can effectively detect and manage SCC, and the Water Chemistry Control – BWR Program limits the concentrations of chemical species known to cause SCC to minimize the environmental effect on SCC.

The staff concludes that for LRA item 3.1.1-97 the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.1.4 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

LRA Table 3.1.1, item 3.1.1-103, addresses stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux, which will be managed for cracking. The GALL Report recommends GALL Report AMP XI.M9, "BWR Vessel Internals," and GALL Report AMP XI.M2, "Water Chemistry," to ensure that this aging effect is adequately managed.

During its review of components associated with item 3.1.1-103, for which the applicant cited generic note A, the staff noted that the LRA credits the BWR Vessel Internals Program and Water Chemistry Control – BWR Program to manage cracking that may occur in the jet pump assembly: slip joint clamp adjustable bolt and ratchet lock spring. However, the staff was unclear whether the jet pump assembly—slip joint clamp adjustable bolt and ratchet lock spring—is within the inspection strategy of the BWRVIP reports that are recommended by the GALL Report for inspection of the jet pump assembly. Specifically, the staff could not confirm which section or table in the BWRVIP-41, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines," dated September 2005, recommends inspections of these components. By letter dated December 23, 2014, the staff issued RAI 3.1.2.3.2-3, requesting that the applicant clarify which inspection methods are used for these components. By letter dated February 5, 2015, the applicant responded, stating that these components are inspected in accordance with BWRVIP-51-A, "Jet Pump Repair Design Criteria," dated September 2005. The staff finds the applicant's response acceptable because the applicant has identified that another BWRVIP report, BWRVIP-51-A, is implemented to inspect these components and because the BWRVIP-51-A report is endorsed by the NRC. The staff's concern identified in RAI 3.1.2.3.2-3 is resolved.

The staff concludes that, for LRA item 3.1.1-103, 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 evaluates aging management, as recommended by the GALL Report, for the reactor vessel, reactor vessel internals, and RCS components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC)
- crack growth due to cyclic loading – PWRs only
- cracking due to SCC – PWRs only
- cracking due to cyclic loading – for BWR with isolation condenser components
- loss of material due to erosion – PWRs only
- cracking due to primary water SCC (PWSCC) – PWRs only
- 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 is associated with LRA Table 3.1.1, item 3.1.1-1 through 3.1.1-11, and addresses the applicant's AMR for managing cumulative fatigue damage in the reactor vessel, reactor vessel internals, and RCPB. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, "Definitions," and is evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed in LRA Sections 4.3.1.

The applicant stated that, items 3.1.1-2, 3.1.1-5, 3.1.1-8, 3.1.1-9, and 3.1.1-10 in LRA Table 3.1.1 are not applicable because they only apply to PWRs. SRP-LR Table 3.1-1 identifies these items as being applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because the applicant's facility is not a PWR.

The staff reviewed LRA Section 3.1.2.2.1, items 3.1.1-1, 3.1.1-3, 3.1.1-4, 3.1.1-6, 3.1.1-7, and 3.1.1-11, against the criteria in SRP-LR Section 3.1.2.2.1, which state that cumulative fatigue damage is a TLAA and must be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed these AMR line items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage.

Based on its review, the staff concludes that the applicant has met the SRP-LR Section 3.1.2.2.1 criteria. For those line items that apply to LRA Section 3.1.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3.1 documents the staff's review of the applicant's evaluation of the TLAA for these components.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the following two criteria in SRP-LR Section 3.1.2.2.2:

(1) LRA Section 3.1.2.2.2, item 1, associated with LRA Table 3.1.1, item 3.1.1-12, addresses loss of material caused by general, pitting, and crevice corrosion in steel PWR steam generator components exposed to secondary feedwater and steam. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff confirmed that the item is applicable only to PWRs and noted that the applicant's unit is a BWR design and does not have steam generators; therefore, the staff finds it acceptable.

(2) LRA Section 3.1.2.2.2, item 2, associated with LRA Table 3.1.1, item 3.1.1-12, addresses loss of material caused by general, pitting, and crevice corrosion in steel PWR steam generator components exposed to secondary feedwater and steam. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff confirmed that the item is applicable only to PWRs and noted that the applicant's unit is a BWR design and does not have steam generators; therefore, the staff finds it acceptable.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.2 criteria do not apply.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Section 3.1.2.2.3 against the following two criteria in SRP-LR Section 3.1.2.2.3:

(1) The staff reviewed LRA Section 3.1.2.2.3, item 1, which is associated with LRA Table 3.1.1, item 3.1.1-13. For components associated with item 3.1.1-13, the LRA states that neutron irradiation embrittlement is a TLAA evaluated in accordance with 10 CFR 54.21(c). The LRA further states that the applicant's evaluation of loss of fracture toughness for the reactor vessel beltline shell and welds is discussed in LRA Section 4.2. The staff's evaluation of the TLAA associated with LRA Table 3.1.1, item 3.1.1-13, is documented in SER Section 4.2.

(2) LRA Section 3.1.2.2.3, item 2, associated with LRA Table 3.1.1, item 3.1.1-14, addresses steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds exposed to a reactor coolant and neutron flux environment, which will be managed by the Reactor Vessel Surveillance Program. The applicant stated that the Reactor Vessel Surveillance Program (LRA AMP B.1.38) uses the BWRVIP ISP to manage reduction in fracture toughness due to neutron embrittlement that may occur in reactor vessel beltline components that are made from ferritic steel materials. The applicant stated that this AMP is consistent with the program described in GALL Report AMP XI.M31, "Reactor Vessel Surveillance."

    The applicable "acceptance criteria" are given in SRP-LR Section 3.1.2.2.3, item 2, which states that the AMP is used to monitor for the amount of neutron irradiation embrittlement that is occurring in the reactor vessel. For BWRs like Fermi 2, the AMP is based on the requirements for ISPs in Appendix H to 10 CFR Part 50. The relevant

AMR items are given in SRP-LR Table 3.1-1, AMR item 14, and GALL Report, AMR item IV.A1.RP-227.

The staff reviewed the applicant's AMR basis for consistency with recommendations in SRP-LR Section 3.1.2.2.3, item 2; AMR item 14 in SRP-LR Table 3.1-1; and AMR item IV.A1.RP-227. The staff verified that the applicant included the applicable AMR items for the reactor vessel beltline components (including those for the N-16 instrumentation nozzles) in LRA Table 3.1-1 and the applicable AMP in LRA Section B.1.38, "Reactor Vessel Surveillance." The staff also noted that the applicant uses that AMP to manage loss of fracture toughness due to neutron irradiation embrittlement in these components consistent with the ISP that is documented in the BWRVIP-86, Revision 1-A, report. The staff verified that this ISP report was approved by the NRC in a safety evaluation dated October 20, 2011 (ADAMS Accession No. ML13176A097) and that the ISP complies with the requirements for ISPs in Appendix H to 10 CFR Part 50. Therefore, based on this review, the staff finds the applicant's basis to be acceptable because it is consistent with the criteria in SRP-LR Section 3.1.2.2.3, item 2, and in GALL Report AMR item IV.A1.RP-227.

The staff's evaluation of the Reactor Vessel Surveillance Program is documented in SER Section 3.0.3.2.19.

(3) LRA Section 3.1.2.2.3, item 3, associated with LRA Table 3.1.1, item 3.1.1-15, addresses a potential plant-specific TLAA for managing loss of ductility properties in stainless steel and nickel alloy reactor vessel internal components that are exposed to a reactor coolant and neutron flux environment. The applicant stated that the aging management topic in SRP-LR Section 3.1.2.2.3, item 3, is not applicable to the CLB for Fermi 2 because it only applies to PWR reactor vessel internal components designed by the Babcock and Wilcox Company. The applicant explained that GE designed the reactor vessel internal components at Fermi 2.

The applicable "acceptance criteria" are given in SRP-LR Section 3.1.2.2.3, item 3, which states that the applicable ductility of reduction analysis is given Technical Report (TR) BAW-2248-A, "Demonstration of the Management of Aging Effects for the Reactor Vessel Internals." This report was approved by the NRC in a safety evaluation dated December 9, 1999 (ADAMS Accession No. ML993490288).

The staff noted that the UFSAR identifies that the nuclear steam supply system components (which include the reactor vessel internal components) for Fermi 2 were designed and furnished by GE. Therefore, the staff finds that TR-BAW-2248-A and the recommendations in SRP-LR Section 3.1.2.2.3, item 3, are not applicable to Fermi 2 because the staff has confirmed that the reactor vessel internal components were not designed by Babcock and Wilcox Company. Instead, the staff has verified that the applicant will manage the aging effects that are applicable to the reactor vessel internal components through implementation of its BWR Vessel Internals Program (LRA AMP B.1.10). The staff's evaluation of the BWR Vessel Internals Program is documented in SER Section 3.0.3.2.3.

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.4 against the following criteria in SRP-LR Section 3.1.2.2.4:

(1) LRA Section 3.1.2.2.4.1, associated with LRA item 3.1.1-16, addresses stainless steel reactor vessel closure head flange leak detection line piping exposed to treated water greater than 140 °F, which will be managed for cracking due to SCC and IGSCC by the Water Chemistry Control – BWR Program and One-Time Inspection Program. The acceptance criteria in SRP-LR Section 3.1.2.2.4.1 state that cracking due to SCC and IGSCC could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC.

The LRA states that the Water Chemistry Control – BWR Program minimizes contaminants that promote SCC. The LRA also indicates that the One-Time Inspection Program will perform NDEs to verify the absence of significant cracking of the leak detection line.

The staff's evaluations of the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.20 and 3.0.3.1.17, respectively. In its review of components associated with LRA item 3.1.1-16, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using these programs is acceptable because the Water Chemistry Control – BWR Program minimizes chemical species known to cause SCC (e.g., sulfur and chloride) and because the One-Time Inspection Program confirms the effectiveness of the water chemistry control to mitigate SCC.

Based on the programs identified, the staff determines that the applicant's programs and aging management evaluation meet the criteria in SRP-LR Section 3.1.2.2.4.1. For those items associated with LRA Section 3.1.2.2.4.1, 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).

(2) LRA Section 3.1.2.2.4, item 2, which is associated with LRA Table 3.1.1, item 3.1.1-17, addresses SCC and IGSCC for stainless steel BWR isolation condenser components exposed to reactor coolant. The applicant stated that this item is not used because Fermi 2 does not have an isolation condenser. The staff reviewed the applicant's UFSAR and confirmed that the design of the applicant's unit does not include an isolation condenser; therefore, the staff finds the applicant's review result acceptable.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5, associated with LRA Table 3.1.1, item 3.1.1-18, addresses crack initiation and growth in PWR reactor vessel forging components that are made from SA-508, Class 2, ferritic steel materials and are clad with stainless steel on their inside surfaces, where the cladding is exposed to a reactor coolant environment. SRP-SLR Section 3.1.2.2.5 identifies that a PWR may include a flaw growth analysis of intergranular separations (underclad cracking) occurring in the stainless steel cladding of reactor vessel forging components made from SA-508, Class 2, ferritic steel materials, where the cladding was welded to the forgings by use of a high heat input welding process. The SRP-SLR also identifies that this type of analysis qualifies as a TLAA for the LRA if the analysis conforms to all six of the criteria for defining TLAAs in 10 CFR 54.3(a).

The applicant stated that these AMR recommendations are not applicable to Fermi 2 because Fermi 2 is a BWR and the guidelines in SRP-LR Section 3.1.2.2.5 are only applicable to PWR-designed reactor vessels. The staff confirmed that this item is associated only with PWRs and, therefore, finds the applicant's claim acceptable.

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6:

(1) LRA Section 3.1.2.2.6, item 1, associated with LRA Table 3.1.1, item 3.1.1-19, addresses cracking caused by SCC in PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff confirmed that this item is associated only with PWRs and, therefore, finds the applicant's claim acceptable.

(2) SRP-LR Section 3.1.2.2.6, item 2, associated with LRA Table 3.1.1, item 3.1.1-20, addresses cracking due to SCC that could occur in Class 1 PWR CASS RCS piping and piping components. In its review, the staff finds that this item is not applicable because the applicant's plant is a BWR.

3.1.2.2.7 Cracking Due to Cyclic Loading

LRA Section 3.1.2.2.7, which is associated with LRA Table 3.1.1, item 3.1.1-21, addresses cracking due to cyclic loading for steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The applicant stated that this item is not used because Fermi 2 does not have an isolation condenser. The staff reviewed the applicant's UFSAR and confirmed that the design of the applicant's unit does not include an isolation condenser; therefore, the staff finds the applicant's review result acceptable.

3.1.2.2.8 Loss of Material Due to Erosion

LRA Section 3.1.2.2.8, associated with LRA Table 3.1.1 item 3.1.1-22, addresses steel steam generator feedwater impingement plates and supports exposed to secondary feedwater, which will be managed for loss of material due to erosion. The criteria in SRP-LR Section 3.1.2.2.8 states that the GALL Report recommends further evaluation of a plant-specific AMP to manage loss of material due to erosion in these material/component combinations.

The applicant addressed the further evaluation criteria of the SRP-LR by stating that LRA Section 3.1.2.2.8, associated with item 3.1.1-22, is applicable to PWRs only, and is therefore not applicable to Fermi 2. The staff confirmed that the item is applicable only to PWRs and noted that the applicant's unit is a BWR design and does not have steam generators; therefore, the staff finds it acceptable.

3.1.2.2.9 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04, “Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized Water Reactors,” dated June 3, 2013.

3.1.2.2.10 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

(1) LRA Section 3.1.2.2.11, item 1, associated with LRA Table 3.1.1, item 3.1.1-25, addresses foreign operating experience in steam generators with a similar design to that of the Westinghouse Electric Company Model 51, which has identified extensive cracking caused by PWSCC in steam generator divider plate assemblies fabricated of Alloy 600 and/or the associated Alloy 600 weld materials, even with proper primary water chemistry (EPRI TR-1014982, “Divider Plate Cracking in Steam Generators,” dated June 2007). The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff confirmed that this item is associated only with PWRs and, therefore, finds the applicant’s claim acceptable.

(2) LRA Section 3.1.2.2.11, item 2, associated with LRA Table 3.1.1, item 3.1.1-25, addresses cracking caused by PWSCC that could occur in steam generator nickel alloy tube-to-tube sheet welds exposed to reactor coolant. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff confirmed that this item is associated only with PWRs and, therefore, finds the applicant’s claim acceptable.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.11 criteria do not apply.

3.1.2.2.12 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.13 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.14 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff’s evaluation of the applicant’s QA program.

3.1.2.2.16 Ongoing Review of Operating Experience

SER Section 3.0.5, “Operating Experience for Aging Management Programs,” documents the staff’s evaluation of the applicant’s consideration of operating experience for 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 3.1.2-4-3, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-4-3, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.1.2.3.1 Reactor Vessel – Summary of Aging Management Evaluation – 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.

Carbon Steel Reactor Vessel Support Skirt Exposed to Indoor Air. In LRA Table 3.1.2-1, the applicant stated that the carbon steel reactor vessel support skirt exposed to indoor air will be managed for loss of material by the Inservice Inspection (ISI) Program. The AMR line item cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, which states that steel pressure vessel support skirt and attachment welds exposed to indoor air (exterior) are susceptible to cracking due to fatigue and recommends treating this aging effect as a TLAA for the period of extended operation. However, the applicant has identified loss of material as an additional aging effect. The applicant addressed the GALL Report identified cracking due to fatigue for this component, material, and environment combination in another AMR item in LRA Table 3.1.2-1.

The staff's evaluations of the ISI Program and TLAAs are documented in SER Sections 3.0.3.1.10 and 4.2, respectively. The staff finds the applicant's proposal to manage the effects of aging using the ISI Program acceptable because the ISI Program manages loss of material for the reactor vessel support skirt through a combination of visual and surface examinations in accordance with ASME Code Section XI, Subsection IWA.

Steel Reactor Vessel Nozzles, Piping, and Piping Components Exposed to External Indoor Air. In LRA Tables 3.1.2-1 and 3.1.2-3, the applicant stated that, for steel reactor vessel nozzles, safe ends, piping, piping components, and portions of the reactor vessel and closure heads exposed to external indoor air, aging effects are not applicable and that no AMP is proposed. The AMR items cite generic note G. The AMR items cite plant-specific note 102, which states that "[h]igh component surface temperature precludes moisture accumulation that could result in corrosion."

The components in LRA Table 3.1.2-1 are associated with reactor vessel nozzles, safe ends, and blind flanges in the direct vicinity of the reactor and the reactor vessel and closure heads and are, therefore, exposed to reactor coolant temperatures during operating and shutdown conditions. Each component in LRA Table 3.1.2-3 is also managed by the External Surfaces Monitoring of Mechanical Components Program for loss of material, citing LRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801," item 3.2.1-40. The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for these component, material, and environment combinations. The staff finds the applicant's proposal acceptable because (a) based on its review of GALL Report, items AP-4 and SP-1, there are no AERMs and no recommended AMP for dry surfaces of steel components exposed to indoor air and (b) with the exception of the components that will also be managed by the External Surfaces Monitoring of Mechanical Components Program, the surface of the cited components would be expected to be dry (i.e., above the dewpoint) during both operating and shutdown conditions.

On the basis of its review, the staff concludes that for items in LRA Table 3.1.2-1 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also concludes for items in this table with an AERM, that the applicant has demonstrated that the effects of aging for these items will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Reactor Vessel Internals – Summary of Aging Management Evaluation – 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.

Nickel Alloy (Alloy X-750) Jet Pump Assembly: Restrainer Bracket and Auxiliary Spring Wedge Assembly Exposed to Treated Water. In LRA Table 3.1.2-2, the applicant stated that the nickel alloy (Alloy X-750) jet pump assembly – restrainer bracket and auxiliary spring wedge assembly components exposed to treated water (ext) – will be managed for loss of material due to wear by the BWR Vessel Internals Program. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed cracking, loss of material, and reduction of fracture toughness for this component, material, and environment combination. These are also included as other AMR items in LRA Table 3.1.2-2. Based on its review of the GALL Report, which states that reactor vessel internals components exposed to reactor coolant and neutron flux should be managed for cracking and loss of fracture toughness, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff noted that the BWR Vessel Internals Program calls for specific inspection techniques to be performed on these components in accordance with the inspection and evaluation methodology in BWRVIP-41. This report demonstrates that the specific types of inspection techniques performed on the components are also capable of detecting loss of material that may occur in the steam dryer assembly components. This is consistent with inspection criteria for the equivalent types of inspection techniques cited by ASME Code Section XI. Therefore, the staff finds that the BWR Vessel Internals Program is an acceptable program for managing loss of material that may occur in these components as well because the inspection techniques are consistent with the NRC-endorsed methodology in BWRVIP-41 and visual inspection criteria specified in the ASME Code Section XI. The staff's evaluation of the applicant's BWR Vessel Internals Program is documented in SER Section 3.0.3.2.3.

Stainless Steel Core Support Plate Rim Hold-Down Bolts Exposed to Treated Water Greater Than 140 °F (ext). In LRA Table 3.1.2-2, the applicant stated that stainless steel core support plate rim hold-down bolts exposed to treated water greater than 140 °F will be managed for loss of preload by the BWR Vessel Internals Program. The AMR item cites generic note H. The staff noted that this material and environment combination is identified in the GALL Report, which states that stainless steel reactor vessel internals components exposed to reactor coolant are susceptible to loss of material and recommends GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and GALL Report AMP XI.M2, "Water Chemistry," to 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 Table 3.1.2-2.

The staff's evaluation of the applicant's BWR Vessel Internals Program is documented in SER Section 3.0.3.2.3. The staff finds the applicant's proposal to manage loss of preload using the BWR Vessel Internals Program acceptable because the program will inspect the core plate components in accordance with BWRVIP-25 and BWRVIP-50-A, which are endorsed by the NRC.

Stainless Steel Steam Dryer Exposed to Treated Water Greater Than 140 °F (ext). In LRA Table 3.1.2-2, the applicant stated that stainless steel steam dryer exposed to treated water greater than 140 °F will be managed for cracking by a combination of the BWR Vessel Internals Program and the Water Chemistry Control – BWR Program. For the use of the BWR Vessel Internals Program, the AMR item cites generic note A. For the use of the Water Chemistry Control – BWR Program, the AMR item cites generic note H and plant-specific note 104, which states that SCC of the steam dryer is not identified as an aging mechanism in the GALL Report.

The staff noted that SCC is not identified in the GALL Report for this MEAP combination and that GALL Report, AMR item IV.B1.RP-155, instead identifies that the steam dryer assembly components are only susceptible to cracking induced by a flow-induced vibration mechanism. However, the staff noted that this AMR item does recommend GALL Report AMP XI.M9, "BWR Vessel Internals," to manage the aging effect of cracking in the steam dryer assembly components. The staff noted that the applicant has conservatively identified SCC as an additional aging effect mechanism that is applicable to these components and that the Water Chemistry Control – BWR Program will be used as an additional AMP, in addition to the BWR Vessel Internals Program, for managing cracking that is induced by a SCC mechanism. The staff finds this to be acceptable because it is consistent with other AMR items in GALL Report Section IV for managing cracking due to SCC in stainless steel or nickel alloy components.

The staff noted that the BWR Vessel Internals Program calls for specific inspection techniques to be performed on these components in accordance with inspection and evaluation methodology in BWRVIP-139-A. This report includes specific inspection techniques to be performed that are capable of detecting and resolving cracks that may be initiated by vibrational fatigue or SCC mechanism. The staff noted that BWRVIP-139-A also demonstrates that the specific types of inspection techniques performed on the components are also capable of detecting loss of material that may occur in the steam dryer assembly components. This is consistent with inspection criteria for the equivalent types of inspection techniques cited by ASME Code Section XI, Subsection IWA. Therefore, the staff finds that the BWR Vessels Internals Program is an acceptable program for managing not only cracking in the steam dryer assembly components but also loss of material that may occur in these components as well because the inspection techniques are consistent with the NRC-endorsed methodology in BWRVIP-139-A and visual inspection criteria specified in the ASME Code Section XI.

The staff's evaluation of the BWR Vessel Internals Program is documented in SER Section 3.0.3.2.3. The staff's evaluation of the applicant's Water Chemistry Control – BWR Program is documented in SER Section 3.0.3.1.20.

<u>Jet Pump Assembly Auxiliary Spring Wedge Assemblies and Slip Joint Clamp Adjustable Bolt and Ratchet Lock Spring Exposed to Treated Water (ext) and Neutron Fluence</u>. LRA Section 4.7.3 discusses the applicant's plant-specific TLAA to evaluate the relaxation of preload of the auxiliary spring wedges in the jet pump assembly due to irradiation-assisted stress relaxation or creep. The applicant dispositioned TLAA 4.7.3 in accordance with 10 CFR 54.21(c)(1)(ii). However, the staff noted that LRA Table 3.1.2-2 does not include any applicable AMR items for managing loss of preload of the jet pump auxiliary spring wedge assembly. By letter dated December 23, 2014, the staff issued RAI 3.1.2.3.2-2, requesting that the applicant justify why the LRA did not include any applicable AMR line items.

By letter dated February 5, 2015, the applicant responded to RAI 3.1.2.3.2-2. The applicant revised LRA Table 3.1.2-2 to include the applicable line item to show the applicant's AMR results for managing loss of preload for the jet pump auxiliary spring wedge assembly. In LRA Table 3.1.2-2, as amended by letter dated February 5, 2015, the applicant stated that a TLAA will be used to manage loss of preload for the nickel alloy (Alloy X-750) jet pump assembly—auxiliary spring wedge assemblies and slip joint clamp adjustable bolt and ratchet lock spring exposed to treated water (ext) and neutron fluence. The applicant cites generic note H for this line item.

The staff finds the applicant's response to RAI 3.1.2.3.2-2 acceptable. The staff's concern addressed in RAI 3.1.2.3.2-2 is resolved.

The staff noted that this material and environment combination is identified in the GALL Report, which states that Alloy X-750 reactor vessel internals components exposed to reactor coolant and neutron flux are susceptible to loss of fracture toughness and cracking and recommends GALL Report AMP XI.M9, "BWR Vessel Internals," and GALL Report AMP XI.M2, "Water Chemistry," to manage the aging effects. 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 Table 3.1.2-2.

The staff confirmed that there is a TLAA, as documented in LRA Section 4.7.3, for managing loss of preload for these components, which the applicant dispositioned in accordance with

10 CFR 54.21(c)(1)(ii). The staff's evaluation of the applicant's plant-specific TLAA 4.7.3 is documented in SER Section 4.7.3. The staff finds the applicant's proposal to manage loss of preload using plant-specific TLAA 4.7.3 acceptable because the applicant provided the appropriate fluence and projected loss of preload values that demonstrate that the analysis has been appropriately projected to the end of the period of extended operation and will remain below the threshold value for inducing preload loss such that the components will maintain their intended function during the period of extended operation.

Jet Pump Assembly Slip Join Clamp Body Exposed to Treated Water Greater Than 140 °F (ext) and Neutron Fluence. LRA Section 4.7.4 discusses the applicant's plant-specific TLAA to evaluate the relaxation of preload of the slip joint repair clamp in the jet pump assembly due to irradiation-assisted stress relaxation or creep. The applicant dispositioned TLAA 4.7.4 in accordance with 10 CFR 54.21(c)(1)(ii). However, the staff noted that LRA Table 3.1.2-2 does not include any applicable AMR items for managing loss of preload of the jet pump slip joint repair clamp. By letter dated December 23, 2014, the staff issued RAI 3.1.2.3.2-2, requesting that the applicant justify why the LRA did not include any applicable AMR line items.

By letter dated February 5, 2015, the applicant responded to RAI 3.1.2.3.2-2. The applicant revised LRA Table 3.1.2-2 to include the applicable line item to show the applicant's AMR results for managing loss of preload for the jet pump slip joint repair clamp. In LRA Table 3.1.2-2, as amended by letter dated February 5, 2015, the applicant stated that a TLAA will be used to manage loss of preload for the stainless steel jet pump assembly—slip joint clamp body exposed to treated water greater than 140 °F (ext) and neutron fluence. The applicant cites generic note H for this line item. The staff finds the applicant's response to RAI 3.1.2.3.2-2 acceptable. The staff's concern addressed in RAI 3.1.2.3.2-2 is resolved.

The staff noted that this material and environment combination is identified in the GALL Report, which states that stainless steel reactor jet pump assembly components exposed to reactor coolant and neutron flux are susceptible to cracking and recommends GALL Report AMP XI.M9 "BWR Vessel Internals," and GALL Report AMP XI.M2, "Water Chemistry," to manage the aging effects. 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 Table 3.1.2-2.

The staff confirmed that there is a TLAA, as documented in LRA Section 4.7.4, for managing loss of preload in these components, which the applicant dispositioned in accordance with 10 CFR 54.21(c)(1)(ii). The staff's evaluation of the applicant's plant-specific TLAA 4.7.4 is documented in SER Section 4.7.4. The staff finds the applicant's proposal to manage loss of preload using plant-specific TLAA 4.7.4 acceptable because the neutron flux experienced by the jet pump slip joint repair clamps will remain below the threshold value for loss of preload induced irradiation-assisted stress relaxation such that the components will not experience a loss of preload and will maintain their intended function during the period of extended operation.

On the basis of its review, the staff concludes that for items in LRA Table 3.1.2-2 with an AERM, the applicant has demonstrated that the effects of aging for these items will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Reactor Coolant Pressure Boundary – Summary of Aging Management Evaluation – 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.

Steel Piping and Piping Components Exposed to External Indoor Air. The staff's evaluation for steel piping and piping components exposed to external indoor air with no AERMs and no recommended AMP, which are associated with generic note G, is documented in SER Section 3.1.2.3.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.1.2-3 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.4 Miscellaneous RCS Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Evaluation – LRA Tables 3.1.2-4-1 through 3.1.2-4-3.

The staff reviewed LRA Tables 3.1.2-4-1 through 3.1.2-4-3, which summarizes the results of AMR evaluations for the miscellaneous RCS systems in scope for 10 CFR 54.4(a)(2) component groups.

Nuclear Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.1.2-4-1. The staff reviewed LRA Table 3.1.2-4-1, which summarizes the results of AMR evaluations for the nuclear boiler system, nonsafety-related components affecting safety-related systems. 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 nuclear boiler system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.1.2-4-2.

Stainless Steel Flex Connections Exposed to Wastewater. In LRA Table 3.1.2-4-2 the applicant stated that there is a TLAA for stainless steel and nickel alloy flex connections exposed to wastewater, which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAA for non-Class 1 components, other than piping, is documented in SER Section 4.3.2.2.

Neutron Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.1.2-4-3. The staff reviewed LRA Table 3.1.2-4-3, which summarizes the results of AMR evaluations for the neutron monitoring system, nonsafety-related components affecting safety-related systems. 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 neutron monitoring system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effect of aging for the reactor vessel, internal 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 and component groups of the following items:

- nuclear pressure relief
- residual heat removal
- core spray
- high pressure coolant injection
- reactor core isolation cooling
- containment penetrations
- standby gas treatment
- miscellaneous 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 and component groups. LRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG–1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the ESF systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 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 confirm the applicant's claim that certain AMRs are consistent with the GALL Report, not applicable, or not used. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.2-1, and no further discussion is required. The AMRs that the staff confirmed are not applicable to Fermi 2 or not used, because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another SER Table 3.1-1 item, or that require no aging management are noted in SER 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 consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.2.2.2 acceptance criteria. The staff's evaluations 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 not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations of AMRs not consistent with, or 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 SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	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, verify that plant-specific program addresses clad breach	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.2.2)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel partially-encased tanks with breached moisture barrier exposed to raw water (3.2.1-3)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant specific	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.2.3(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, evironmen-tal conditions need to be evaluated	Not used. There are no stainless steel ESF system components exposed to outdoor air included in the scope of license renewal	Not applicable to Fermi 2 (see SER Section 3.2.2.2.3(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, plant specific	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.2.4)
Steel drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to air – indoor, uncontrolled (internal) (3.2.1-6)	Loss of material due to general corrosion; fouling that leads to corrosion	A plant-specific aging management program is to be evaluated	Yes, plant specific	Not used. There are no steel orifices or spray nozzles exposed to indoor air in the containment spray subsystem of the residual heat removal system.	Not used (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, environ-mental conditions need to be evaluated	Not used. There are no stainless steel ESF system components exposed to outdoor air included in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.2.6)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Steel external surfaces, bolting exposed to air with borated water leakage (3.2.1-9)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated) >250°C (>482°F), treated water >250°C (>482°F) (3.2.1-10)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	Not used. There are no cast austenitic stainless steel components exposed to treated water >250 °C (>482 °F) within the scope of license renewal that are outside the reactor coolant system pressure boundary.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to steam, treated water (3.2.1-11)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion Program	Consistent with the GALL Report
Steel, high-strength closure bolting exposed to air with steam or water leakage (3.2.1-12)	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel; 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 Program Loss of material for steel closure bolting exposed to indoor air is managed by the Bolting Integrity Program. Loss of material is not an aging effect for stainless steel closure bolting in indoor air unless it is exposed to prolonged leakage (an event-driven condition). Nevertheless, the Bolting Integrity Program also applies to stainless steel bolting exposed to indoor air. There is no ESF system bolting exposed to outdoor air in the scope of license renewal.	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. As stated in item 3.2.1-13, loss of material of steel bolting exposed to air in the ESF systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment.	Not used (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
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 Program	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 – BWR and One-Time Inspection programs	Consistent with the GALL Report
Aluminum, stainless steel piping, piping components, and piping elements exposed to treated water (3.2.1-17)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report
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 – BWR and One-Time Inspection programs	Consistent with the GALL Report
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 – BWR and One-Time Inspection programs	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements; tanks exposed to treated water (borated) >60°C (>140°F) (3.2.1-20)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry" and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements; tanks exposed to treated water (borated) (3.2.1-22)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry” and Chapter XI.M32, “One-Time Inspection”	No	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.1.1)
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	Service Water Integrity Program	Consistent with the GALL Report
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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Stainless steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water (3.2.1-25)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Service Water Integrity Program	Consistent with the GALL Report
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	Service Water Integrity Program	Consistent with the GALL Report
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 used. There are no steel ESF system heat exchanger tubes exposed to raw water in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to 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	Water Chemistry Control – Closed Treated Water Systems and Inservice Inspection programs	Consistent with the GALL Report
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 used. There are no steel ESF system piping components exposed to closed-cycle cooling water in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to closed-cycle cooling water (3.2.1-30)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Water Chemistry Control – Closed Treated Water Systems Program	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 Program	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	Water Chemistry Control – Closed Treated Water Systems Program	Consistent with the GALL Report
Copper alloy, stainless steel heat exchanger tubes exposed to closed-cycle cooling water (3.2.1-33)	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Water Chemistry Control – Closed Treated Water Systems Program	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	Selective Leaching Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water (3.2.1-36)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not applicable	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to soil (3.2.1-37)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not used. There are no ESF system components exposed to soil in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Elastomers, elastomer seals and components exposed to air – indoor, uncontrolled (external) (3.2.1-38)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not used. There are no elastomer ESF system components in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
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	External Surfaces Monitoring Program	Consistent with the GALL Report
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 Program	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	External Surfaces Monitoring Program	Consistent with the GALL Report
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 used. There are no aluminum ESF system components exposed to outdoor air in the scope of license renewal.	Not applicable to Fermi 2 (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
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 used. There are no elastomer ESF system components in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Steel piping and components (internal surfaces), ducting and components (internal surfaces) exposed to air – indoor, uncontrolled (internal) (3.2.1-44)	Loss of material due to general corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Internal Surfaces in Miscellaneous Piping and Ducting Components, Periodic Surveillance and Preventive Maintenance, and External Surfaces Monitoring programs	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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Steel piping and components (internal surfaces) exposed to condensation (internal) (3.2.1-46)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report
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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements (internal surfaces); tanks exposed to condensation (internal) (3.2.1-48)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-49)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Oil Analysis and One-Time Inspection programs	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 programs	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 programs	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 used. There are no buried or underground ESF system components exposed to soil or concrete in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete (3.2.1-53)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not used. There are no buried or underground ESF system components exposed to soil or concrete in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
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 used. There are no buried or underground ESF system components exposed to condensation in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
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 used. Stainless steel components of the ESF systems subject to evaluation under the BWR Stress Corrosion Cracking Program were reviewed as part of the Class 1 reactor coolant pressure boundary.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel 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.	Consistent with NUREG-1801, “Generic Aging Lessons Learned (GALL) Report”	Consistent with the GALL Report
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, “Generic Aging Lessons Learned (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, “Generic Aging Lessons Learned (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	Not applicable to BWRs (see SER Section 3.2.2.1.1)
Galvanized steel ducting, piping, and components exposed to air – indoor, controlled (external) (3.2.1-59)	None	None	NA - No AEM or AMP	Not used. Galvanized steel is evaluated as steel.	Not used (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, "Generic Aging Lessons Learned (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	Not used. There are no nickel alloy ESF system components exposed to indoor air in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Nickel alloy piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-62)	None	None	NA - No AEM or AMP	Not used. There are no nickel alloy ESF system components exposed to indoor air in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air with borated water leakage, concrete, gas, air – indoor, uncontrolled (internal) (3.2.1-63)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," for stainless steel components exposed to indoor air and gas.	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	Consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," for components exposed to gas.	Consistent with the GALL Report
Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated) (3.2.1-65)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Metallic piping, piping components, and tanks exposed to raw water or wastewater (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	Periodic Surveillance and Preventive Maintenance Program	Consistent with the GALL Report (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 used. There are no stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Chapter XI.M29, "Aboveground Metallic Tanks") in the ESF systems	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.2.1-68)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not used. There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Chapter XI.M29, "Aboveground Metallic Tanks") in the ESF systems	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Insulated steel, stainless steel, copper alloy, or aluminum, piping, piping components, and tanks exposed to condensation, air-outdoor (3.2.1-69)	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks," (for tanks only)	No	External Surfaces Monitoring Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 used. There are no steel, stainless steel, or aluminum tanks (consistent with the scope of NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” Chapter XI.M29, “Aboveground Metallic Tanks”) in the ESF systems.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Insulated stainless steel, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor (3.2.1-71)	Cracking due to stress corrosion cracking	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components,” or Chapter XI.M29, “Aboveground Metallic Tanks” (for tanks only)	No	Not used. There are no stainless steel, aluminum, or copper alloy insulated piping components or tanks exposed to condensation or outdoor air in the ESF systems.	Not applicable to Fermi 2 (see SER Section 3.2.2.1.1)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.2.1-72)	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Coating Integrity Program	Consistent with the GALL Report (see SER Section 3.2.2.3.2)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.2.1-73)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not used	Not used (see SER Section 3.2.2.1.1)
Gray cast iron piping components with internal coatings/linings exposed to closed cycle cooling water, raw water, or treated water (3.2.1-74)	Loss of material due to selective leaching	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not used	Not used (see SER Section 3.2.2.1.1)

3.2.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.2.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the ESF systems components:

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems
- Buried and Underground Piping
- Coating Integrity
- Periodic Surveillance and Preventive Maintenance

LRA Tables 3.2.2-1 through 3.2.2-8-6 summarize AMRs for the ESF systems components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report, for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine if the plant-specific components of 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 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, but 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 reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.2.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.2.1, items 3.2.1-8, 3.2.1-9, 3.2.1-20, 3.2.1-21, 3.2.1-22, 3.2.1-24, 3.2.1-35, 3.2.1-36, 3.2.1-45, 3.2.1-47, and 3.2.1-58, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to Fermi 2, which is a BWR.

For LRA Table 3.2.1, items 3.2.1-10, 3.2.1-14, 3.2.1-29, 3.2.1-37, 3.2.1-38, 3.2.1-42, 3.2.1-43, 3.2.1-52, 3.2.1-53, 3.2.1-53.5, 3.2.1-54, 3.2.1-59, 3.2.1-61, 3.2.1-62, 3.2.1-67, 3.2.1-68, 3.2.1-70, and 3.2.1-71, the applicant claimed that the corresponding items in the GALL Report are not applicable or are not used because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another Table 1 line item. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items or that the aging effects addressed by other Table 1 AMR line items are appropriate.

LRA Table 3.2.1, item 3.2.1-27 addresses both stainless steel and steel heat exchanger tubes exposed to raw water. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to manage reduction of heat transfer for this component group. The applicant stated that this item is not used because there are no steel heat exchanger tubes exposed to raw water in ESF systems. The staff notes that, although there are stainless steel heat exchanger tubes exposed to raw water in ESF systems, the applicant will manage reduction of heat transfer for these components by using item 3.2.1-26. The staff evaluated the applicant's claim and finds it acceptable because the item cited by the applicant uses the Service Water Integrity Program, which corresponds to the Open-Cycle Cooling Water System

Program in the GALL Report, and it is appropriate for managing the associated stainless steel heat exchanger tubes.

SER Table 3.2-1, items 3.2.1-73 and 3.2.1-74, reflect changes to the SRP-LR incorporated by LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." The ISG added these line items to allow applicants to credit the new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; or selective leaching in certain components. The applicant did not credit the related plant-specific AMP, "Coating Integrity," for the aging effect and components that reference SRP-LR items 3.2.1-73 and 3.2.1-74 but instead credited alternate items and programs to manage the effects of these aging mechanisms for these components. For example, in regard to item 3.2.1-73, loss of material for the internally coated residual heat exchanger end channels is managed by the Service Water Integrity Program. In regard to item 3.2.1-74, there are no gray cast iron components in the engineered safety feature systems. The staff finds this approach acceptable because the alternate items and programs used are adequate to manage the effects of aging for these components and because this approach is consistent with GALL Report AMP XI.M42.

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 or Periodic Surveillance and Preventive Maintenance (PSPM) programs 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 ensure 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 3.0.3.2.7. 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 RFO. LRA Table 3.2-1, item 3.2.1-44, 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 RFO are sufficient to identify the potential for corrosion of component internal surfaces when the internal and external environments are the same.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The program proposes to manage the effects of aging for the recombiner system component internal surfaces in the containment atmosphere control system through the use of periodic visual inspections or other established NDE techniques 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, the staff finds the applicant's proposal to manage the effects of aging using the PSPM Program acceptable because visual or other NDE testing at a frequency of at least once every 5 years is similar to the inspection approach recommended by the GALL Report and is capable of identifying loss of material before 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 is associated with LRA Table 3.2.1, item 3.2.1-1, addresses steel and stainless steel piping, piping components, and piping elements exposed to treated water (borated), which will be managed for cumulative fatigue damage. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, and is evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.2.2.2.1 against the criteria in SRP-LR Section 3.2.2.2.1, which state that cumulative fatigue damage of steel and stainless steel piping, piping components, and piping elements is a TLAA and is to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed the applicant's AMR line items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage in steel and stainless steel piping, piping components, and piping elements.

Based on its review, the staff concludes that the applicant has met the SRP-LR Section 3.2.2.2.1 criteria. For those line items that apply to LRA Section 3.2.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3 documents the staff's review of the applicant's evaluation of the TLAA for these components.

3.2.2.2.2 Loss of Material Due to Cladding Breach

LRA Section 3.2.2.2.2, associated with LRA Table 3.2.1, item 3.2.1-2, addresses loss of material due to cladding breach in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The applicant stated that this item is not applicable because it only applies to PWRs. The staff confirmed that this item is associated only with PWR plants; therefore, the staff finds the applicant's determination acceptable.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3 against the following criteria in SRP-LR Section 3.2.2.2.3:

(1) LRA Section 3.2.2.2.3, associated with LRA Table 3.2.1, item 3.2.1-3, addresses partially encased stainless steel tanks exposed to raw water. The criterion 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 the engineered safety features systems do not have any partially encased stainless steel tanks. The staff evaluated the applicant's claim and finds it acceptable because, based on walkdowns performed during the audit and a review of the UFSAR, the staff verified that the applicant does not have partially encased stainless steel tanks.

(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 used because there are no stainless steel components exposed to outdoor air in the engineered safety features 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 UFSAR and verified that there are no in-scope stainless steel components exposed to outdoor air in the engineered safety features systems.

3.2.2.2.4 Loss of Material Due to Erosion

LRA Section 3.2.2.2.4 is associated with LRA Table 3.2.1, item 3.2.1-5, and addresses loss of material due to erosion of stainless steel minimum flow orifices for PWR high-pressure safety injection pumps exposed to treated borated water. The applicant stated that item 3.2.1-5 is not applicable because it only applies to PWRs. The staff evaluated the applicant's claim and finds it acceptable because item 3.2.1-5 addresses the use of the high-pressure safety injection pumps for normal charging in PWRs and does not apply to Fermi 2.

3.2.2.2.5 Loss of Material Due to General Corrosion and Fouling That Leads to Corrosion

LRA Section 3.2.2.2.5, associated with LRA Table 3.2.1, item 3.2.1-6, addresses loss of material due to general corrosion and fouling that leads to corrosion in steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to uncontrolled indoor air. The applicant stated that for item 3.2.1-6 the applicability is limited to steel orifices or spray nozzles exposed to indoor air and is, therefore, not used. The staff confirmed that the applicant’s containment spray nozzles are copper alloy and that no steel orifices are present in the containment spray subsystem. The staff also noted that GALL Report, item V.F.EP-10, identifies copper alloy components exposed to indoor air as having no aging effect and mechanism and does not recommend an AMP.

However, the staff noted that this further evaluation subsection includes plugging of the spray nozzles and discusses internal surface corrosion of the steel spray systems in the drywell and suppression chamber. The staff also noted that nozzle plugging can be caused by the buildup of corrosion products from upstream components, not just corrosion of the nozzles themselves. The staff further noted that even though this system is in standby the majority of the time, the wetting and drying of these components can accelerate corrosion and lead to flow blockage due to fouling. Based on this, by letter dated December 24, 2014, the staff issued RAI 3.2.2.2-1, requesting that the applicant provide information on the potential for internal corrosion in the spray systems for the drywell and suppression chamber as it relates to plugging of the associated spray nozzles.

In its response dated February 5, 2015, the applicant confirmed that the drywell sprays are not credited and are not within the scope of license renewal. The applicant stated that the suppression chamber atmosphere is inerted to less than 4 percent oxygen during power operation, which reduces the potential for corrosion. The applicant also stated that flow rates greater than 500 gpm were achieved during the last 16 quarterly surveillances of the suppression pool spray system and that, if significant blockage were to develop, the flow rates through the spray header would indicate a decreasing trend. The applicant further stated that the spray header material and environment combination is included in the Water Chemistry Control – BWR Program and the One-Time Inspection Program.

In its review of the applicant’s response, the staff noted that, although the inerted atmosphere may reduce the amount of corrosion, there appears to be sufficient oxygen in the water within the system to support general corrosion based on the ongoing operating experience for the corrosion of components in BWR suppression pools. In addition, the staff noted the operating experience included in the James A. Fitzpatrick Nuclear Power Plant license renewal SER that discussed blockage in some suppression pool spray nozzles found during surveillance tests, and it was unclear to the staff whether the applicant’s quarterly surveillance required flow-rate trending and whether flow-rate trending alone could detect the development of similar flow blockage. Additionally, it was not clear to the staff that the internal environment of the suppression pool spray header would be considered as a uniquely classified environment within the One-Time Inspection Program because of the periodic wetting and drying. By letter dated March 26, 2015, the staff issued RAI 3.2.2.2-1a requesting that the applicant address the above issues.

In its response dated April 27, 2015, the applicant stated that based on the spray nozzle design capacity, a total flow rate of approximately 700 gpm or greater is expected when flow testing through the suppression pool nozzles. However, because the current surveillance testing acceptance criteria is 500 gpm, there is a potential for the acceptance criteria to be met with several spray nozzles blocked. Consequently, the applicant will perform air flow testing, similar to the testing currently being performed for the drywell spray nozzles, as part of the PSPM Program at least once every 5 years. In addition, the applicant added an AMR item with a generic note H to LRA Table 3.2.2-2 indicating that the PSPM Program will manage "flow blockage due to fouling" for the spray nozzles. In addition, the applicant added plant-specific note 206 to LRA Table 3.2.2-2, stating that portions of the spray piping are normally dry, but wetted during periodic system testing and that a one-time inspection activity will confirm that loss of material is not occurring or is occurring slowly. The applicant also modified LRA Sections A.1.33 and B.1.33 to reflect the above changes to the One-Time Inspection Program and Sections A.1.35 and B.1.35 to reflect the above changes to the PSPM Program.

The staff finds the applicant's response acceptable because implementing new periodic inspections using an air test through the PSPM Program will be adequate to manage flow blockage due to fouling in the suppression pool spray nozzles. In addition, performing inspections on a representative sample of the periodically wetted suppression pool spray piping through the One-Time Inspection Program will ensure that any loss of material in the associated portion of the RHR system will not affect component intended function during the period of extended operation. Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.2.2.2.5 criteria. For those items associated with LRA Section 3.2.2.2.5, 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 during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff's concerns described in RAIs 3.2.2.2-1 and 3.2.2.2-1a are resolved.

3.2.2.2.6 Cracking Due to Stress Corrosion Cracking

LRA Section 3.2.2.2.6, associated with LRA Table 3.2.1, item 3.2.1-7, addresses cracking due to SCC in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.2.2.2.6 state that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and in which condensation or deliquescence is possible. The applicant stated that this item is not used because there are no stainless steel components exposed to outdoor air, including air that has recently been introduced into buildings, in the ESFs 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 UFSAR and verified that there are no in-scope stainless steel components exposed to outdoor air, or air which has recently been introduced into buildings, in the ESFs 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 operating experience for AMPs.

3.2.2.2.9 Loss of Material Due to Recurring Internal Corrosion

LRA Section 3.2.2.2.9, associated with LRA Table 3.2.1, item 3.2.1-66, addresses metallic piping, piping components, and tanks exposed to raw water or wastewater, which will be managed for loss of material due to recurring internal corrosion by the PSPM Program. 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 an operating experience search for repeated instances in which an aging effect resulted in a component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent. The applicant addressed the further evaluation criteria of the SRP-LR by stating that recurring internal corrosion was identified in carbon steel piping components exposed to raw water in the ESF systems. The applicant also stated that this aging effect will be managed with the PSPM Program by monitoring wall thickness at selected locations and by replacing pipe where necessary.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The program includes periodic wall thickness measurements at selected locations based on pipe configuration, flow conditions, and operating history. A minimum of five inspections of carbon steel piping exposed to raw water will be performed each year until the rate of recurring internal corrosion occurrences no longer meets the operating experience criteria in the further evaluation that prompted the augmented inspections.

In its review of components associated with item 3.2.1-66, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the PSPM Program is acceptable because the applicant's proposal increases the minimum number and frequency of inspections beyond that recommended by the GALL Report such that recurring corrosion can be effectively monitored before a loss of intended function. The GALL Report program to manage the internal surfaces of piping in raw water (outside of the fire protection and safety-related service water systems), GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," recommends the inspection of a maximum of 25 locations in each 10-year period, with no provision to perform inspections every year. In contrast, the applicant proposes to examine a minimum of 50 locations in each 10-year period, with inspections occurring each year.

Based on the program identified, the staff determines that the applicant's program meets the criteria in SRP-LR Section 3.2.2.2.9. For those items associated with LRA Section 3.2.2.2.9, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-8-6, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-8-6, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations 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 Nuclear Pressure Relief System – 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 nuclear pressure relief component groups.

Steel Piping Exposed to Treated Water. In LRA Tables 3.2.2-1, 3.2.2-2, 3.2.2-3, 3.2.2-4, and 3.2.2-5, the applicant stated that carbon steel piping exposed to treated water will be managed for loss of material by the One-Time Inspection Program. The AMR items cite generic note G and plant-specific note 203, which states that the environment may alternate between wet and dry for the piping that passes through the waterline region of the suppression pool and that the One-Time Inspection Program will use visual or other NDE techniques to inspect this piping to manage the potential accelerated loss of material.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. The staff noted that the applicant is also using the Water Chemistry Control – BWR Program to manage loss of material for this piping. Based on its review of the GALL Report, which states that steel piping, piping components, and piping elements exposed to treated water should be managed for loss of material due to general, pitting, and crevice 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 One-Time Inspection Program is documented in SER Section 3.0.3.1.17. During the staff's review of these items and the One-Time Inspection Program, it noted that plant-specific note 203 states that the One-Time Inspection Program will inspect the piping "to manage the potential accelerated loss of material," whereas a table in LRA Section B.1.33, "One-Time Inspection," states that the one-time inspection "will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function." To clarify this apparent disparity, by letter dated December 23, 2014, the staff issued RAI 3.2.2.3.1-1 to request that the applicant clarify the intent of the use of the One-Time Inspection Program.

By letter dated February 5, 2015, the applicant stated that significant loss of material is not expected nor has it been observed at Fermi 2. Water quality in the torus is controlled in accordance with the Water Chemistry Control – BWR Program, and the torus is normally inerted in the piping splash zone. Additionally, the applicant stated that, in accordance with its One-Time Inspection Program, if there is any indication or relevant condition of degradation, it will be evaluated, as well as any need for followup examinations. The applicant revised plant-specific note 203 to be consistent with the wording in LRA Sections A.1.33 and B.1.33 and added "gas" as an environment for the relevant AMR items.

The staff finds the applicant's response and proposal to manage the effects of aging using the One-Time Inspection Program acceptable because it clarified that an accelerated loss of material is not expected and revised the LRA accordingly. Additionally, the applicant stated that, in accordance with its One-Time Inspection Program, any indication or relevant condition of degradation will be evaluated. The staff's concern described in RAI 3.2.2.3.1-1 is resolved.

Stainless Steel Flex Connections Exposed to Steam. In LRA Table 3.2.2-1, the applicant stated that there is a TLAA for stainless steel flex connections exposed to steam that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAA for non-Class 1 components, other than piping, is documented in SER Section 4.3.2.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-1 with an AERM, the applicant has demonstrated that the effects of aging for these items will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Residual Heat Removal System – Summary of Aging Management Evaluation – LRA Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the RHR component groups.

Carbon Steel Heat Exchanger Components and Tanks Exposed to Treated Water, Raw Water, and Lubricating Oil. As amended by letter dated February 15, 2015, LRA Tables 3.2.2-2 and 3.2.2-4 state that carbon steel heat exchanger components and tanks exposed to treated water, raw water, and lubricating oil will be managed for loss of coating integrity by the Coating Integrity Program. The AMR items cite generic note H.

The staff noted that, although the applicant cited generic note H, 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," provides AMR line items to address this MEAP combination. SRP-LR Table 3.2-1, item 3.2.1-72 states that metallic heat exchangers and tanks with internal coatings/linings exposed to raw water, treated water, or lubricating oil are managed for loss of coating integrity by GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks."

The staff's evaluation of the applicant's Coating Integrity Program is documented in SER Section 3.0.3.2.24. The staff finds the applicant's proposal to manage the effects of aging using the Coating Integrity Program acceptable because periodic visual inspections of internal coatings by qualified personnel are capable of detecting loss of coating integrity.

Copper Alloy Nozzles Exposed to Treated Water. In LRA Table 3.2.2-2, as modified in its response dated April 27, 2015, to RAI 3.2.2.2-1a, the applicant stated that copper alloy nozzles exposed to treated water will be managed for flow blockage due to fouling by the PSPM 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 copper-alloy piping components are susceptible to loss of material and recommends GALL Report AMP XI.M2, "Water Chemistry" and GALL Report AMP XI.M32, "One-Time Inspection" programs to manage the aging effect. However, the applicant has identified flow blockage due to fouling as an additional aging effect for the suppression pool spray nozzles. The applicant addressed the GALL Report-identified aging effect for this component, material, and environment combination in other AMR items in LRA Table 3.2.2-2.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The staff finds the applicant's proposal to manage flow blockage due to fouling using the PSPM Program acceptable because the new periodic surveillance will use air testing similar to the periodic testing that has been shown to be effective for the detection of flow blockage in the drywell spray nozzles.

Steel Piping Exposed to Treated Water. The staff's evaluation for steel piping exposed to treated water, which will be managed for loss of material by the One-Time Inspection Program and is associated with generic note G, is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-2 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Core Spray – 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 core spray component groups.

Steel Piping Exposed to Treated Water. The staff's evaluation for steel piping exposed to treated water, which will be managed for loss of material by the One-Time Inspection Program and is associated with generic note G, is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-3 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.4 High-Pressure Coolant Injection – Summary of Aging Management Evaluation – LRA Table 3.2.2-4

The staff reviewed LRA Table 3.2.2-4, which summarizes the results of AMR evaluations for the system name component groups.

Carbon Steel Heat Exchanger Components and Tanks Exposed to Treated Water, Raw Water, and Lubricating Oil. The staff's evaluation for carbon steel heat exchanger components and tanks exposed to treated water, raw water, and lubricating oil, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.2.2.3.2.

Carbon Steel, Aluminum, and Copper Alloy Heat Exchanger Components Exposed to Indoor and Outdoor Air. In LRA Tables 3.2.2-4 and 3.3.2-9, the applicant stated that carbon steel heat exchanger fins exposed to indoor air and aluminum and copper alloy heat exchanger fins and tubes exposed to outdoor air will be managed for fouling by the External Surfaces Monitoring Program. The AMR items cite generic notes H (carbon steel) and G (aluminum and copper alloy).

The staff noted that these material and environment combinations are identified in the GALL Report; however, the GALL Report does not provide any guidance for the management of fouling of heat exchanger surfaces in air environments. The applicant has identified fouling as an applicable aging effect. The applicant addressed the GALL Report-identified aging effect of loss of material for the copper alloy heat exchanger tubes in another AMR item in LRA Table 3.3.2-9. The applicant did not address loss of material for the carbon steel and aluminum heat exchanger fins, which were cited as having only a heat transfer intended function. Nevertheless, the visual inspections for fouling conducted by the External Surfaces Monitoring Program discussed below also are capable of identifying loss of material before the heat transfer function of the fins being challenged. Therefore, the staff finds that the applicant has identified all credible aging effects for these component, material, and environment combinations.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. 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 fouling of the heat exchanger surfaces before loss of the intended function.

Stainless Steel Piping, Tubing, and Valve Bodies Exposed to Steam. In LRA Table 3.2.2-4, the applicant stated that there are TLAAs for stainless steel piping, tubing, and valve bodies exposed to steam; these TLAAs cite generic note H. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.1, for these components and material. The staff's evaluation of the fatigue TLAAs for Class 1 piping components and valves is documented in SER Section 4.3.1.6.

Steel Piping Exposed to Treated Water. The staff's evaluation for steel piping exposed to treated water, which will be managed for loss of material by the One-Time Inspection Program and is associated with generic note G, is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-4 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.5 Reactor Core Isolation Cooling – Summary of Aging Management Evaluation – LRA Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the reactor core isolation cooling component groups.

Stainless Steel Piping, Tubing, Orifices, and Valve Bodies Exposed to Steam. In LRA Table 3.2.2-5, the applicant stated that there are TLAAs for stainless steel piping, tubing, orifices, and valve bodies exposed to steam; the TLAAs cite generic note H. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.1, for these components and material. The staff's evaluation of the fatigue TLAAs for Class 1 piping components and valves is documented in SER Section 4.3.1.6.

Steel Piping Exposed to Treated Water. The staff's evaluation for steel piping exposed to treated water, which will be managed for loss of material by the One-Time Inspection Program and is associated with generic note G, is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-5 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.6 Containment Penetrations – Summary of Aging Management Evaluation – LRA Table 3.2.2-6

The staff reviewed LRA Table 3.2.2-6, which summarizes the results of AMR evaluations for the containment penetrations 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 containment penetrations component groups are consistent with the GALL Report.

3.2.2.3.7 Standby Gas Treatment – Summary of Aging Management Evaluation – LRA Table 3.2.2-7

The staff reviewed LRA Table 3.2.2-7, which summarizes the results of AMR evaluations for the standby gas treatment component groups.

Fiberglass Moisture Separators Exposed to Wastewater. In LRA Table 3.2.2-7, the applicant stated that fiberglass moisture separators exposed to wastewater will be managed for cracking and changes in material properties 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 the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report, which states that fiberglass piping exposed to raw water is susceptible to cracking, blistering, and change in color due to water absorption, 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 3.0.3.1.11. 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 cracking and changes in material properties in the fiberglass separators by observing for cracking, other surface discontinuities, and discoloration.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-7 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.8 Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Evaluation – LRA Tables 3.2.2-8-1 through 3.2.2-8-6

The staff reviewed LRA Tables 3.2.2-8-1 through 3.2.2-8-6, which summarize the results of AMR evaluations for the miscellaneous ESF systems in scope for 10 CFR 54.4(a)(2) component groups.

Residual Het Removal System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.2.2-8-1

Carbon Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel and Nickel Alloy Piping, Piping Components, Heat Exchanger Components, and Tanks Exposed to Condensation. In LRA Tables 3.2.2-8-1, 3.3.2-3, 3.3.2-5, 3.3.2-10, 3.3.2-11, 3.3.2-12, 3.3.2-17-3, 3.3.2-17-16, and 3.3.2-17-17, the applicant stated that stainless steel piping, piping components, heat exchanger components, and tanks and nickel alloy flex connections 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 the credible aging effects for this component, material, and environment description. The GALL Report states that stainless steel and nickel alloys are susceptible only to loss of material in a condensation 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 External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The GALL Report contains guidance for managing loss of material of stainless steel and nickel alloy components in a condensation environment for internal surfaces only and recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to manage this aging effect. That program uses opportunistic and periodic visual inspections to identify loss of material. The applicant has identified these material and environment combinations for external surfaces and has, therefore, proposed the External Surfaces Monitoring Program to manage loss of material. 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 before loss of the intended function.

On the basis of its review, the staff concludes that for items in LRA Table 3.2.2-8-1 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.2.2-8-2

The staff reviewed LRA Table 3.2.2-8-2, which summarizes the results of AMR evaluations for the core spray system, nonsafety-related components affecting safety-related systems. 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 core spray systems, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

High-Pressure Coolant Injection System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.2.2-8-3

The staff reviewed LRA Table 3.2.2-8-3, which summarizes the results of AMR evaluations for the high-pressure coolant injection system, nonsafety-related components affecting safety-related systems. 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 high-pressure coolant injection system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Reactor Core Isolation Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.2.2-8-4

Stainless Steel Piping Exposed to Steam. In LRA Table 3.2.2-8-4, the applicant stated that there is a TLAA for stainless steel piping exposed to steam; the TLAA cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAA for non-Class 1 piping is documented in SER Section 4.3.2.1.

Containment Penetrations, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.2.2-8-5

The staff reviewed LRA Table 3.2.2-8-5, which summarizes the results of AMR evaluations for the containment penetrations, nonsafety-related component affecting safety-related systems. 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 containment penetrations, nonsafety-related component affecting safety-related systems are consistent with the GALL Report.

Standby Gas Treatment System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.2.2-8-6

The staff reviewed LRA Table 3.2.2-8-6, which summarizes the results of AMR evaluations for the standby gas treatment system, nonsafety-related components affecting safety-related systems. 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 standby gas treatment system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effect of aging for the engineered safety features 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).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups of the following items:

- control rod drive system
- standby liquid control system
- service water system
- fuel pool cooling and cleanup system
- emergency equipment cooling water system
- compressed air system
- fire protection – water system
- fire protection – CO_2 and halon system
- combustion turbine generator system
- emergency diesel generator system
- heating, ventilation and air conditioning system
- control center heating, ventilation and air conditioning system
- containment atmospheric control system
- plant drains system
- fuel oil system
- primary containment monitoring and leakage detection system
- miscellaneous 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 and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of the applicant's AMRs to confirm the applicant's claim that certain AMRs are consistent with the GALL Report, not applicable, or not used. 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. The AMRs that the staff confirmed are consistent with the GALL Report are noted as such in SER Table 3.3-1, and no further discussion is required. The AMRs that the staff confirmed are not applicable to Fermi 2 or not used, because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another SER Table 3.1-1 item, or that require no aging management are noted in SER Table 3.3-1 and are 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 3.3.2.1.14.

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 3.3.2.2 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 not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations of AMRs not consistent with, or not addressed in, the GALL Report are documented in SER Section 3.3.2.3.

SER Table 3.3-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs that are listed in LRA Section 3.3 and are 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 (see Standard Review Plan (SRP), 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	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 SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	TLAA	Consistent with the GALL Report (see SER Section 3.3.2.2.1)
Stainless steel heat exchanger components, non-regenerative exposed to treated borated water >60°C (>140°F) (3.3.1-3)	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M2, "Water Chemistry." The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, plant-specific	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.2.2)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel 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, environ-mental conditions need to be evaluated	External Surfaces Monitoring Program	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, verify that plant-specific program addresses clad cracking	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.2.4)
Stainless steel piping, piping components, and piping elements; tanks exposed to air–outdoor (3.3.1-6)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environ-mental conditions need to be evaluated	External Surfaces Monitoring Program	Consistent with the GALL Report (see SER Section 3.3.2.2.5)
Stainless steel high-pressure pump, casing exposed to treated borated water (3.3.1-7)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.1.1)
Stainless steel heat exchanger components and tubes exposed to treated borated water >60°C (>140°F) (3.3.1-8)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.1.1)
Steel, aluminum, copper alloy (>15% Zn or >8% Al) external surfaces, piping, piping components, and piping elements, bolting exposed to air with borated water leakage (3.3.1-9)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.1.1)
Steel, high-strength closure bolting exposed to air with steam or water leakage (3.3.1-10)	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	Not used. There is no high-strength steel closure bolting used in auxiliary systems within the scope of license renewal.	Not applicable to Fermi 2 (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, high-strength high-pressure pump, closure bolting exposed to air with steam or water leakage (3.3.1-11)	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, “Bolting Integrity”	No	Not used. There is no high-strength steel closure bolting used in auxiliary systems within the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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 Program. Loss of material for steel and stainless steel bolting is managed by the Bolting Integrity Program.	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. As stated in item 3.3.1-12, loss of material of steel bolting exposed to air in the auxiliary systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment.	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 Program	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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel 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 used. Reactor water cleanup system piping downstream of the second containment isolation valve, 4 inch NPS or greater that is above 200 °F during power operation, is carbon steel and is not subject to NRC Generic Letter 88-01 requirements.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Stainless steel heat exchanger tubes exposed to treated water, treated borated water (3.3.1-17)	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not used. There are no stainless steel heat exchanger tubes exposed to treated water with an intended function of heat transfer in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Stainless steel high-pressure pump, casing, piping, piping components, and piping elements exposed to treated borated water >60°C (>140°F), sodium pentaborate solution >60°C (>140°F) (3.3.1-18)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not used. The operating temperature of the standby liquid control system is below the 140 °F threshold for cracking in stainless steel.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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. Regenerative heat exchanger components with an intended function for license renewal are made of carbon steel.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, stainless steel; steel with stainless steel cladding 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 – BWR and One-Time Inspection programs	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	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report
Copper-alloy piping, piping components, and piping elements exposed to treated water (3.3.1-22)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report
Aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-23)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not used. Loss of material for aluminum components exposed to treated water is addressed in item 3.3.1-25	Not used (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 used. Loss of material for aluminum components exposed to treated water is addressed in item 3.3.1-25.	Not used (see SER Section 3.3.2.1.1)
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	Water Chemistry Control – BWR and One-Time Inspection programs	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) 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 used. Elastomer linings are not credited for protection of piping in the scope of license renewal.	Not used (see SER Section 3.3.2.1.1)
Stainless steel heat exchanger tubes exposed to treated water (3.3.1-27)	Reduction of heat transfer due to fouling	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not used. There are no stainless steel heat exchanger tubes exposed to treated water with an intended function of heat transfer in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements, piping; tanks exposed treated borated water (primary, oxygen levels controlled) >60°C (>140°F) (3.3.1-28)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.1.1)
Steel (with stainless steel cladding); stainless steel piping, piping components, and piping elements exposed to treated borated water (primary, oxygen levels controlled) (3.3.1-29)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry”	No	Not applicable	Not applicable to BWRs (see SER Section 3.3.2.1.1)
Concrete; cementitious material piping, piping components, and piping elements exposed to raw water (3.3.1-30)	Changes in material properties due to aggressive chemical attack	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Fiberglass, HDPE piping, piping components, and piping elements exposed to raw water (internal) 3.3.1-30.5)	Cracking, blistering, change in color due to water absorption	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not used. There are no fiberglass or HDPE components exposed to raw water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Concrete; cementitious material Piping, piping components, and piping elements exposed to raw water (3.3.1-31)	Cracking due to settling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to raw water (3.3.1-32)	Cracking due to aggressive chemical attack and leaching; changes in material properties due to aggressive chemical attack	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not used. There are no reinforced concrete or asbestos cement components exposed to raw water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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 used. There are no elastomer components exposed to raw water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Concrete; cementitious material piping, piping components, and piping elements exposed to raw water (3.3.1-33)	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (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
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 used. There are no nickel alloy components exposed to raw water in the auxiliary systems in the scope of license renewal. Copper alloy piping components exposed to raw water are addressed in item 3.3.1-36.	Not used (see SER Section 3.3.2.1.1)
Copper-alloy piping, piping components, and piping elements exposed to raw water (3.3.1-35)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not used. Copper alloy piping components exposed to raw water are addressed in item 3.3.1-36.	Not used (see SER Section 3.3.2.1.1)
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	Service Water Integrity Program	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-37)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Service Water Integrity Program	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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel 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. Stainless steel piping components exposed to raw water are addressed in items 3.3.1-40 and 3.3.1-41.	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 Program	Consistent with the GALL Report
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	Service Water Integrity Program	Consistent with the GALL Report
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 Periodic Surveillance and Preventive Maintenance programs	Consistent with the GALL Report (see SER Section 3.3.2.1.2)
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 Program	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	Not used. There are no stainless steel heat exchanger components exposed to closed-cycle cooling water >60 °C (>140 °F) in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, copper alloy 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 Program	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	Water Chemistry Control – Closed Treated Water Systems Program	Consistent with the GALL Report
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 used. There are no aluminum components exposed to closed-cycle cooling water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (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 Program	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 Program	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	Boraflex Monitoring Program	Not applicable to Fermi 2 (see SER Section 3.3.2.1.3)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel 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 Program	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	Not used. Loss of material due to wear is the result of relative movement between two surfaces in contact with each other. General wear of crane rails may occur during the performance of the active function; as a result of improper design, application, or operation; or, to a very small degree, with insignificant consequences. Additionally, wear of crane rails due to rolling or sliding wheels is not expected in any measurable amount owing to infrequent crane use. Therefore, loss of material due to wear is not an aging effect requiring management for crane rails exposed to air-indoor, uncontrolled. However, the condition of steel crane rails is monitored by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program under item 3.3.1-52.	Not used (see SER Section 3.3.2.1.4)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 Program	Consistent with the GALL Report
Steel piping, piping components, and piping elements: compressed air system exposed to condensation (internal) (3.3.1-55)	Loss of material due to general and pitting corrosion	Chapter XI.M24, “Compressed Air Monitoring”	No	Compressed Air Monitoring Program	Consistent with the GALL Report
Stainless steel Piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-56)	Loss of material due to pitting and crevice corrosion	Chapter XI.M24, “Compressed Air Monitoring”	No	Compressed Air Monitoring Program	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 Program	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 Program	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 and Structures Monitoring programs	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 programs	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 programs	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 programs	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 Program	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 Program	Consistent with the GALL Report
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-65)	Loss of material due to pitting and crevice corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Not used. There are no aluminum auxiliary system components exposed to raw water in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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 Program	Consistent with the GALL Report
Steel tanks exposed to air – outdoor (external) (3.3.1-67)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Aboveground Metallic Tanks Program	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to fuel oil (3.3.1-68)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection"	No	Not used. Loss of material for steel components exposed to fuel oil is addressed in item 3.3.1-70.	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
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 programs	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 Program and One-Time Inspection programs	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 programs	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, wastewater (3.3.1-72)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Selective Leaching Program	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 used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor (3.3.1-74)	Cracking due to settling	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (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
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 used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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 Program	Consistent with the GALL Report (see SER Section 3.3.2.1.5)
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 used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Steel piping and components (external surfaces), ducting and components (external surfaces), ducting; closure bolting exposed to air – indoor, uncontrolled (external), air – indoor, uncontrolled (external), air – outdoor (external), condensation (external) (3.3.1-78)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	External Surfaces Monitoring, Fire Protection, and Service Water Integrity programs	Consistent with the GALL Report (see SER Section 3.3.2.1.6)
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 Program	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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 and Service Water Integrity programs	Consistent with the GALL Report (see SER Section 3.3.2.1.7)
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 Program	Consistent with the GALL Report (see SER Section 3.3.2.1.8)
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	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report (see SER Section 3.3.2.1.9)
The SRP-LR, as amended by ISGs, does not list and Item No. (3.3.1-84)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
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	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report
Elastomers 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	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report
The SRP-LR, as amended by ISGs, does not list an Item No. (3.3.1-87)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, copper-alloy piping, piping components, and piping elements exposed to 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 Program	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	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report
Steel piping, piping components, and piping elements; tanks exposed to wastewater (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 programs	Consistent with the GALL Report (see SER Section 3.3.2.1.10)
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 Program	Consistent with the GALL Report (see SER Section 3.3.2.1.11)
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 Program	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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 wastewater, 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 programs	Consistent with the GALL Report (see SER Section 3.3.2.1.12)
Elastomers 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 Program	Consistent with the GALL Report (see SER Section 3.3.2.1.8)
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 and One-Time Inspection programs	Consistent with the GALL Report
Steel heat exchanger components exposed to lubricating oil (3.3.1-98)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Oil Analysis and One-Time Inspection programs	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 programs	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-100)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Oil Analysis and One-Time Inspection programs	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 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 used. There are no aluminum heat exchanger tubes exposed to lube oil with an intended function of heat transfer in systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
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 Program	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 used. There are no buried concrete components in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (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 used. There are no fiberglass or HDPE components exposed to soil or concrete in the systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Concrete cylinder piping, asbestos cement pipe piping, piping components, and piping elements exposed to soil or concrete (3.3.1-105)	Cracking, spalling, corrosion of rebar due to exposure of rebar	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not used. There are no concrete or asbestos cement components exposed to soil or concrete in the systems in the scope of license renewal.	Not applicable to Fermi 2 (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 (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 Program	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 used. There are no buried or underground stainless steel or nickel alloy components exposed to soil or concrete in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Titanium, super austenitic, aluminum, copper alloy, stainless steel, nickel alloy piping, piping components, and piping elements, bolting exposed to soil or concrete (3.3.1-108)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not used. None of the component type, material, and environment combinations represented by this item apply to components in auxiliary systems included in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Steel bolting exposed to soil or concrete (3.3.1-109)	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping Program	Consistent with the GALL Report
Underground aluminum, copper alloy, stainless steel, nickel alloy and 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	Buried and Underground Piping Program	Consistent with the GALL Report
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 used. Stainless steel components of the auxiliary systems subject to evaluation under the BWR Stress Corrosion Cracking Program were reviewed as part of the Class 1 reactor coolant pressure boundary.	Not applicable to Fermi 2 (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 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. Aging management review results for structural steel components are presented in, and compared to, NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” items in LRA Section 3.5.	Not used (see SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements exposed to concrete (3.3.1-112)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Consistent with NUREG-1801, “Generic Aging Lessons Learned (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 NUREG-1801, “Generic Aging Lessons Learned (GALL) Report.”	Consistent with the GALL Report
Copper-alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – dry, gas (3.3.1-114)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801, “Generic Aging Lessons Learned (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	Not applicable to BWRs (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
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. Galvanized (zinc) coating applied to some steel components is not credited for corrosion protection for license renewal.	Not used (see SER Section 3.3.2.1.1)
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 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."	Consistent with the GALL Report
Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) (3.3.1-118)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."	Consistent with the GALL Report
Nickel alloy, PVC, glass piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal), wastewater (3.3.1-119)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," for glass components exposed to waste water.	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 air – indoor, uncontrolled (internal/external), air – indoor, uncontrolled (external), air with borated water leakage, concrete, air – dry, gas (3.3.1-120)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801, “Generic Aging Lessons Learned (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	NA - No AEM or AMP	Consistent with NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” for steel components exposed to gas.	Consistent with the GALL Report
Titanium heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled or air – outdoor (3.3.1-122)	None	None	NA - No AEM or AMP	Not used. There are no titanium components included in systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Titanium (ASTM Grades 1,2, 7, 11, or 12 that contains > 5% aluminum or more than 0.20% oxygen or any amount of tin) heat exchanger components other than tubes, piping, piping components, and piping elements exposed to raw water (3.3.1-123)	None	None	NA - No AEM or AMP	Not used. There are no titanium components included in systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel (with stainless steel or nickel-alloy cladding) spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements; exposed to treated water >60°C (>140°F), treated borated water >60°C (>140°F) (3.3.1-124)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	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 – BWR and One-Time Inspection programs	Consistent with the GALL Report
Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated), raw water (3.3.1-126)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion and Service Water Integrity programs	Consistent with the GALL Report (see SER Section 3.3.2.1.13)
Metallic piping, piping components, and tanks exposed to raw water or wastewater (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	Periodic Surveillance and Preventive Maintenance Program	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 used. There are no stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the auxiliary systems. Loss of material for steel tanks in outdoor air is addressed in item 3.3.1-67.	Not applicable to Fermi 2 (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 tanks exposed to soil or concrete; air-indoor uncontrolled, raw water, treated water, wastewater, condensation (3.3.1-129)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Aboveground Metallic Tanks Program	Consistent with the GALL Report
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 Program	Consistent with the GALL Report
Steel, stainless steel, copper alloy, or aluminum fire water system piping, piping components and piping elements exposed to air-indoor uncontrolled (internal), air-outdoor(internal), or condensation (internal) (3.3.1-131)	Loss of material due to general (steel, and copper alloy only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, “Fire Water System”	No	Fire Water Systems and Periodic Surveillance and Preventive Maintenance programs	Consistent with the GALL Report (see SER Section 3.3.2.1.14)
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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 used. There are no underground HDPE piping components in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Steel, stainless steel, or copper-alloy piping, piping components, and piping elements, and heat exchanger components exposed to a raw water environment (for nonsafety-related components not covered by NRC GL 89-13) (3.3.1-134)	Loss of material due to general (steel and copper alloy only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with the GALL Report
Steel or stainless steel pump casings submerged in a wastewater (internal and external) environment (3.3.1-135)	Loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.MI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not used. There are no steel or stainless steel pump casings exposed internally and externally to waste water in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Steel, stainless steel or aluminum fire water storage tanks exposed to air-indoor uncontrolled, air-outdoor, condensation, moist air, raw water, treated water (3.3.1-136)	Loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M27, "Fire Water System"	No	Not used. There are no fire water storage tanks in the auxiliary systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel or aluminum 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 used	Not applicable to Fermi 2 (see SER Section 3.3.2.1.1)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, or fuel oil (3.3.1-138)	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Coating Integrity Program	Consistent with the GALL Report (see SER Section 3.3.2.3.3)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.3.1-139)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not used	Not used (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Gray cast iron piping components with internal coatings/linings exposed to closed cycle cooling water, raw water, or treated water (3.3.1-140)	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not used	Not used (see SER Section 3.3.2.1.1)

3.3.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Aboveground Metallic Tanks
- Bolting Integrity
- Boraflex Monitoring
- Buried and Underground Piping
- Compressed Air Monitoring
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Protection
- Fire Water System
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Neutron-Absorbing Material Monitoring
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

LRA Tables 3.3.2-1 through 3.3.2-17-36 summarize AMRs for the auxiliary system components and indicate AMRs that 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 of 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 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 reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.3.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.3.1, items 3.3.1-7, 3.3.1-8, 3.3.1-9, 3.3.1-28, 3.3.1-29, and 3.3.1-115, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to Fermi 2, which is a BWR.

For LRA Table 3.3.1, items 3.3.1-10, 3.3.1-11, 3.3.1-13, 3.3.1-16, 3.3.1-17, 3.3.1-18, 3.3.1-19, 3.3.1-27, 3.3.1-30, 3.3.1-30.5, 3.3.1-31, 3.3.1-32, 3.3.1-32.5, 3.3.1-33, 3.3.1-44, 3.3.1-48, 3.3.1-65, 3.3.1-73, 3.3.1-74, 3.3.1-75, 3.3.1-77, 3.3.1-101, 3.3.1-103, 3.3.1-104, 3.3.1-105, 3.3.1-107, 3.3.1-108, 3.3.1-110, 3.3.1-111, 3.3.1-116, 3.3.1-122, 3.3.1-123, 3.3.1-128, 3.3.1-133, 3.3.1-135, 3.3.1-136, and 3.3.1-137, the applicant claimed that the corresponding items in the GALL Report are not applicable or are not used because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another Table 1 line item. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items or that the aging effects addressed by other Table 1 AMR line items are appropriate.

LRA Table 3.3.1, items 3.3.1-23 and 3.3.1-24, address aluminum piping, piping components, and piping elements exposed to treated water. The GALL Report recommends GALL Report AMPs XI.M2, "Water Chemistry," and XI.M32, "One-Time Inspection," to manage loss of material due to pitting and crevice corrosion for this component group. The applicant stated that these AMR items are not used because loss of material for these aluminum components exposed to treated water are addressed by AMR item 3.3.1-25. The staff evaluated the applicant's claim and found it acceptable because item 3.3.1-25 manages the loss of material for aluminum piping, piping components, and piping elements exposed to treated water in a manner consistent with items 3.3.1-23, 3.3.1-24 and the GALL Report recommendations. The staff also verified that aluminum piping components exposed to treated water in the auxiliary systems reference item 3.3.1-25.

The staff concludes that, for AMR items 3.3.1-23 and 3.3.1-24, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

LRA Table 3.3.1, item 3.3.1-26, addresses loss of material for steel (with elastomer lining), steel (with elastomer lining or stainless steel cladding) piping, piping components, and piping elements exposed to treated water. The applicant stated that this item is not used because elastomer linings are not credited for protection of in-scope piping. Subsequent to the issuance of the LRA, the staff issued LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." LR-ISG-2013–01, which recommends GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage loss of coating or liner integrity. In addition, LR-ISG-2013-01 revised Table 3.3.1, item 3.3.1-26 to remove the reference to elastomer linings. By letter dated February 15, 2015, the applicant revised its LRA to address LR-ISG-2013-01. The staff noted that the applicant revised LRA Tables 3.2.2-3, 3.3.2-7, 3.3.2-10, 3.3.2-15, 3.3.2-17-5, 3.3.2-17-15, and 3.3.2-17-28 to address steel piping and tanks exposed to various environments being managed for loss of coating integrity and cited generic note H for these AMR items. The staff's evaluation of the addition of these new line items is documented in SER Section 3.3.2.3.3.

LRA Table 3.3.1, items 3.3.1-34 and 3.3.1-35 address nickel alloy and copper-alloy piping, piping components, and piping elements exposed to raw water. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to manage loss of material due to various corrosion mechanisms for this component group. The applicant stated that these items are not used because copper-alloy piping components exposed to raw water are addressed in item 3.3.1-36. The staff evaluated the applicant's claim and finds it acceptable because the item cited by the applicant uses the Service Water Integrity Program, which corresponds to the Open-Cycle Cooling Water System Program in the GALL Report, and because it is appropriate for managing the associated copper-alloy piping components.

LRA Table 3.3.1, item 3.3.1-39 addresses stainless steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to manage loss of material due to various corrosion mechanisms for this component group. The applicant stated that this item is not used because stainless steel piping components exposed to raw water are addressed in items 3.3.1-40 and 3.3.1-41. The staff evaluated the applicant's claim and finds it acceptable because the items cited by the applicant use the Service Water Integrity Program, which corresponds to the Open-Cycle Cooling Water System Program in the GALL Report, and because they are appropriate for managing the associated stainless steel piping components.

LRA Table 3.3.1, item 3.3.1-68, addresses steel piping, piping components, and piping elements exposed to fuel oil. The GALL Report recommends GALL Report AMPs XI.M30, "Fuel Oil Chemistry," and 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 used because it is addressed by item 3.3.1-70. The staff evaluated the applicant's claim and finds it acceptable because item 3.3.1-70 addresses steel piping, piping components, and piping elements; tanks exposed to fuel oil. The GALL Report also recommends GALL Report AMPs XI.M30 and XI.M32 to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion.

SER Table 3.3-1, items 3.3.1-139 and 3.3.1-140, reflect changes to the SRP-LR incorporated by LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." The ISG added these line items to allow applicants to credit the new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; or selective leaching in certain components. The applicant did not credit the related plant-specific AMP, "Coating Integrity," for the aging effect and components that reference SRP-LR items 3.3.1-139 and 3.3.1-140 but instead credited alternate items and programs to manage the effects of these aging mechanisms for these components. For example, in regard to item 3.3.1-139, loss of material for the internally coated service water piping is managed by the Service Water Integrity Program. In regard to item 3.3.1-140, the no gray cast iron valve bodies exposed to raw water in the auxiliary systems are managed for loss of material due to selective leaching by the Selective Leaching Program. The staff finds this approach acceptable because the alternate items and programs used are adequate to manage the effects of aging for these components and this approach is consistent with GALL Report AMP XI.M42.

3.3.2.1.2 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3.1, item 3.3.1-42 addresses copper alloy, stainless steel, and titanium heat exchanger tubes exposed to raw water, which will be managed for fouling. For the AMR item that cites generic note E, the LRA credits the PSPM Program to manage the aging effect for copper alloy heat exchanger tubes. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that this aging effect is adequately managed.

GALL Report AMP XI.M20 recommends using periodic performance monitoring or visual inspections to manage fouling of heat exchanger tubes.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The staff notes that this program proposes to manage the effects of aging for copper alloy heat exchanger tubes by visually inspecting the internal surfaces of the heat exchanger tubes at least once every 5 years. Based on its review of components associated with item 3.3.1-42 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 it will perform comparable inspections at a comparable frequency as that of the Open-Cycle Cooling Water System Program, which are capable of detecting fouling before a loss of intended function.

The staff concludes that LRA item 3.3.1-42, 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 Reduction of Neutron-Absorbing Capacity Due to Boraflex Degradation

LRA Table 3.3.1, item 3.3.1-51, addresses Boraflex spent fuel storage racks: neutron-absorbing sheets (PWR); spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water. The GALL Report recommends GALL Report AMP XI.M22, "Boraflex Monitoring," to manage reduction of neutron-absorbing capacity due to Boraflex degradation. In a letter dated September 24, 2015, the applicant provided supplemental information on the continued use of the Boraflex material in the Fermi 2 spent fuel pool. The applicant stated that the Boraflex currently used in the spent fuel racks will not be credited for neutron absorption during the period of extended operation. Accordingly, the Boraflex Monitoring Program will not be relied upon during the period of extended operation. The applicant revised LRA Table 3.3.1, item 3.3.1-51, to no longer credit the Boraflex material or the Boraflex Monitoring Program during the period of extended operation. The staff's evaluation of the discontinued reliance on the Boraflex material and the Boraflex Monitoring Program is documented in SER Section 3.0.3.2.2.

3.3.2.1.4 Loss of Material Due to Wear

LRA Table 3.3.1, item 3.3.1-53 addresses steel cranes – rails exposed to air – indoor, uncontrolled (external). The GALL Report recommends GALL Report 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 this item is not used because of the following:

> [W]ear of crane rails due to rolling or sliding wheels is not expected in any measurable amount owing to infrequent crane use…[and that] the condition of steel crane rails is monitored by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program under Item 3.3.1-52.

The staff reviewed the applicant's claim and noted that item 3.3.1-52 of the SRP-LR manages loss of material due to general corrosion. The staff also noted that item 3.3.1-52 is used by the applicant in LRA Table 3.5.2-1, "Reactor/Auxiliary Building and Primary Containment," and

Table 3.5.2-3, “Turbine Building, Process Facilities and Yard Structures,” for loss of material and for the same material (steel) and similar components as those managed by item 3.3.1-53. The staff further noted 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 specifies conformance of cranes and hoists to the American National Standard, (ASME B30.2, “Overhead and Gantry Cranes” safety standard, which is implemented in the proposed enhanced Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program; reviewed and documented in SER Section 3.0.3.2.13; and, for crane usage, to the Crane Manufacturers Association of America Specification No. 70 (CMAA-70).

LRA Section 4.7.7, “Crane (Heavy Load) Cycles,” states that the reactor building crane meets the CMAA-70 Class A service (very infrequent usage) crane criteria with 7,170 anticipated number of lifts, which are well below the historical record of 500 annual lifts discussed in NUREG-0612. The turbine building crane is a limited access crane in accordance with UFSAR Section 12.1.2.2.3, “Turbine Building,” and is not subject to lift cycles consistent with the Electric Overhead Crane Institute Specification No. 61 (EOCI-61), “Specifications for Electric Traveling Cranes,” as verified by the staff during the audit.

The staff finds the proposed approach acceptable because the proposed enhanced Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and another line item monitor loss of material for corrosion or limited wear of the reactor and turbine building crane rails, because of the very infrequent crane usage, and because of the applicant’s implementation of ASME B30.2 safety standard for corrosion/wear inspection guidance by the proposed enhanced Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program.

3.3.2.1.5 Hardening and Loss of Strength Due to Elastomer Degradation

LRA Table 3.3.1, item 3.3.1-76 addresses elastomeric flex connections exposed to indoor uncontrolled air (internal and external), which will be managed for hardening and loss of strength due to elastomer degradation. The GALL Report recommends GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” to ensure that this aging effect is adequately managed.

LRA Tables 3.3.2-9 and 3.3.2-11 state that flex connections exposed to internal indoor air will be managed for cracking by the External Surfaces Monitoring Program. These components are also being managed for loss of material due to wear by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff’s evaluation of the applicant’s External Surfaces Monitoring and Internal Surfaces in Miscellaneous Piping and Ducting Components programs is documented in SER Sections 3.0.3.2.7 and 3.0.3.1.11, respectively. The staff recognizes that internal cracking will not be detected by the External Surfaces Monitoring Program unless the cracking extends to the external surface of the component. However, the staff finds the applicant’s proposal to manage cracking on the internal surfaces of these components acceptable because the periodic visual and physical manipulation inspections for loss of material due to wear on internal surfaces can detect internal cracking in these components.

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).

3.3.2.1.6 Loss of Material Due to General Corrosion

LRA Table 3.3.1, item 3.3.1-78, addresses carbon steel piping, ducting, and components that are exposed to indoor air, outdoor air, and condensation and that will be managed for loss of material due to general corrosion. For the AMR items that cite generic note E, the LRA credits the Service Water Integrity Program to manage the aging effect for carbon steel piping in the service water system and the Fire Protection Program to manage the aging effect for carbon steel piping and valve bodies in the CO_2 and halon system. The GALL Report recommends GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M36 recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's Service Water Integrity Program is documented in SER Section 3.0.3.2.21. The staff noted that LRA Section B.1.41 states that the program includes system walkdowns. In addition, as stated in LRA Table 3.3.1, item 3.3.1-78, the Service Water Integrity Program manages loss of material of the external surfaces of outdoor components in the service water system that are not routinely accessible for inspection under the External Surfaces Monitoring Program. Specifically, these components are associated with the RHR MDCTs. As referenced in the staff's Audit Report of this program, the Service Water Integrity Program includes activities for inspecting the cooling tower component external surfaces when they become accessible (Station Procedures E1156 B001A and B; B002A and B). Based on its review of the subject service water 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 Service Water Integrity Program acceptable because inspections of external surfaces whenever the components become accessible are capable of identifying loss of material before loss of intended functions.

The staff's evaluation of the applicant's Fire Protection Program is documented in SER Section 3.0.3.2.9. The staff noted that the Fire Protection Program proposes to manage the effects of aging of carbon steel piping and valve bodies in the CO_2 and halon system through the use of periodic visual inspections and functional tests. The staff noted that this approach is consistent with that recommended in GALL Report AMP XI.M26, "Fire Protection," which states that periodic visual inspections and functional tests are performed to examine for signs of corrosion that may lead to loss of material. Based on its review of components in the CO_2 and halon system 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 Fire Protection Program acceptable because periodic visual inspections are capable of detecting loss of material due to general corrosion.

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).

3.3.2.1.7 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-81, addresses copper alloy and aluminum piping, piping components, and piping elements exposed to outdoor air, 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 Service Water Integrity Program to manage the aging effect for copper alloy nozzles in the service water system. The GALL Report recommends GALL Report

AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” to ensure that this aging effect is adequately managed. GALL Report AMP XI.M36 recommends using periodic visual inspections to manage the effects of aging.

The staff’s evaluation of the applicant’s Service Water Integrity Program is documented in SER Section 3.0.3.2.21. The staff noted that LRA Section B.1.41 states that the program includes system walkdowns. In addition, as stated in LRA Table 3.3.1, item 3.3.1-78, the Service Water Integrity Program manages loss of material of the external surfaces of outdoor components in the service water system that are not routinely accessible for inspection under the External Surfaces Monitoring Program. Specifically, these components are associated with the RHR MDCTs. As referenced in the staff’s Audit Report of this program, the Service Water Integrity Program includes activities for inspecting the cooling tower component external surfaces when they become accessible (Station Procedures E1156 B001A and B; B002A and B). 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 Service Water Integrity Program acceptable because inspections of external surfaces whenever the components become accessible are capable of identifying loss of material before loss of intended functions.

The staff concludes that, for LRA item 3.3.1-81, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.8 Loss of Material Due to Wear

LRA Table 3.3.1, items 3.3.1-82 and 3.3.1-96, address elastomeric components exposed to indoor uncontrolled air (external and internal), which will be managed for loss of material due to wear. The GALL Report recommends GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” and AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” respectively, to ensure that this aging effect is adequately managed.

LRA Table 3.3.2-6 states that elastomeric flex connections exposed to indoor air (external and internal) will be managed for change in material properties and cracking by the External Surfaces Monitoring and Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The table does not cite loss of material due to wear for these components. During the audit, the staff confirmed that these flex connections consist of flexible elastomeric hoses. GALL Report Section IX.F, “Selected Definitions & Use of Terms for Describing and Standardizing Aging Mechanisms,” states that wear can be due to intermittent relative motion, frequent manipulation, loosening of clamping force, or abrasive particles. The staff finds it acceptable that the applicant is not managing these components for loss of material due to wear because (a) flexible hoses are designed to accommodate relative motion and frequent manipulation with no degradation, (b) flexible hoses and their end fittings are not susceptible to loosening of clamping force, and (c) plant indoor air does not contain adequate abrasive particles to cause wear.

The staff concludes that, for LRA items 3.3.1-82 and 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).

3.3.2.1.9 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-83, addresses stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends GALL Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” in order to manage loss of material due to pitting and crevice corrosion and cracking due to SCC for this component group. The applicant originally stated that they did not use this item and provided a discussion stating that “[t]he configuration of stainless steel diesel engine exhaust components precludes moisture collection necessary to concentrate contaminates, so these components are not susceptible to cracking.”

The staff evaluated the applicant’s claim and found it unclear how the configuration of the stainless steel exhaust components prevent the accumulation of moisture and how the effects of other contaminants that may accumulate even without the collection of moisture are mitigated. By letter dated December 17, 2014, the staff issued RAI 3.3.2.3-1, requesting that the applicant state the basis as to why this material, environment, and aging effect combination does not apply or explain how loss of material due to pitting and crevice corrosion and cracking due to SCC will be managed for these components.

In its response dated January 15, 2015, the applicant cited Appendix D Table 4-1 of Appendix D to EPRI TR-1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4,” dated January 2006, and stated that “[s]usceptibility to pitting and crevice corrosion for stainless steel in an air/gas environment requires the presence of three conditions, including a wetted surface and potential for concentrating contaminants.” The applicant also stated that the vertical orientation of the EDG exhaust expansion joints preclude the accumulation of moisture needed to concentrate contaminants; therefore, pitting and crevice corrosion is not an applicable aging affect for this component.

The staff evaluated the applicant’s response and found that, for most components, a vertical orientation would prevent the wetted condition for this aging effect. However, the staff found it unclear how the vertical orientation of the EDG exhaust expansion joints precludes the accumulation of moisture because stainless steel expansion joints generally include many vertical and horizontal segments and crevices, which can prevent proper drainage and allow for moisture accumulation in any orientation. By letter dated February 20, 2015, the staff issued followup RAI 3.3.2.3-1a, requesting that the applicant state the basis for why the EDG exhaust expansion joint’s vertical orientation precludes the collection of moisture or explain how it would manage loss of material due to pitting and crevice corrosion and stress corrosion cracking in these components during the period of extended operation.

In its response dated March 19, 2015, the applicant revised LRA Table 3.3.2-10 to include AMR line items, which cite stainless steel expansion joints exposed to exhaust gas that will be managed for cracking and loss of material using the Internal Surfaces and Miscellaneous Piping and Ducting Components Program.

The staff noted that the Internal Surfaces and Miscellaneous Piping and Ducting Components Program conducts visual inspections to detect cracking and loss of material. The staff finds this response acceptable because the applicant revised the LRA to ensure that it has identified the appropriate aging effects for the material and environment combination of the EDG exhaust expansion joints and that visual inspections are capable of detecting loss of material and cracking in stainless steel components. The staff’s concern described in RAI 3.3.2.3-1a is resolved.

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).

3.3.2.1.10 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-91, addresses carbon steel piping, piping components, piping elements, and tanks exposed to wastewater, 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 carbon steel piping, piping components, and tanks. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M38 recommends using opportunistic visual inspections, with a representative sample of components inspected at least once every 10 years, to manage the effects of aging.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The program proposes to manage the effects of aging of the internal surfaces of a representative sample of carbon steel piping, piping components, and tanks through the use of periodic visual inspections (or ultrasonic inspections of components in the fuel pool cooling and cleanup system) with a frequency of at least once every 5 years. The LRA states that a representative sample is 20 percent of each population with the same material, environment, and aging effect combination, 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 periodic visual or ultrasonic inspection of a representative sample of components is similar to the inspection approach recommended by the GALL Report and is capable of identifying loss of material before loss of component intended functions.

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 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 Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-92, addresses aluminum piping, piping components, and piping elements exposed internally to condensation, 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 Compressed Air Monitoring Program to manage this aging effect for aluminum valve bodies. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to ensure that the noted aging effect is adequately managed. GALL Report AMP XI.M38 recommends using visual inspections of all accessible surfaces whenever the piping or ducting is opened for any reason and minimally during each 10-year period during the period of extended operation on a sampling basis.

The staff's evaluation of the applicant's Compressed Air Monitoring Program is documented in SER Section 3.0.3.2.4. The staff noted that Compressed Air Monitoring Program proposes to manage the effects of aging for aluminum valve bodies through the use of periodic and opportunistic inspections of accessible internal surfaces of piping and other 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 aging using the Compressed Air Monitoring Program acceptable because the opportunistic and periodic visual inspections of accessible internal surfaces of the valve bodies for any signs of loss of material will ensure that, if such degradation is occurring, it 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).

3.3.2.1.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-95 addresses stainless steel and copper-alloy piping, piping components, piping elements, and tanks exposed to wastewater, 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 stainless steel, copper alloy, and copper alloy with greater than 15 percent zinc or 8 percent aluminum piping, piping components, and tanks. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M38 recommends using opportunistic visual inspections, with a representative sample of components inspected at least once every 10 years, to manage the effects of aging.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The program proposes to manage the effects of aging of the internal surfaces of a representative sample of piping, piping components, and tanks through the use of periodic visual inspections with a frequency of at least once every 5 years. The LRA states that a representative sample is 20 percent of each population with the same material, environment, and aging effect combination, 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 periodic visual inspection of a representative sample of components is similar to the inspection approach recommended by the GALL Report and is capable of identifying loss of material before loss of component intended functions.

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).

3.3.2.1.13 Wall Thinning Due to Erosion

LRA Table 3.3.1, item 3.3.1-126, addresses piping, piping components and piping elements exposed to treated water, treated borated water, and raw water, which will be managed for wall thinning due to erosion. For the AMR items that cite generic note E, the LRA credits the Service Water Integrity Program to manage the aging effect for carbon steel, stainless steel, and copper-alloy piping, tubing, pump casings, valves, flow elements, nozzles, thermowells, and orifices. The GALL Report recommends GALL Report AMP XI.M17, "Flow-Accelerated

Corrosion” to ensure that this aging effect is adequately managed through the use of periodic thickness measurements.

The staff’s evaluation of the applicant’s Service Water Integrity Program is documented in SER Section 3.0.3.2.21. The staff notes that the Service Water Integrity Program proposes to manage the effects of aging for various components through routine inspections and maintenance activities. The staff also notes that the LRA includes an enhancement to the “detection of aging effects” program element to revise the Service Water Integrity Program procedures by including inspections to identify loss of material due to erosion in the system. Based on its review of components associated with item 3.3.1-126 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the Service Water Integrity Program acceptable because the program is being specifically enhanced to include loss of material due to erosion.

The staff concludes that, for LRA item 3.3.1-126, 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 Flow Blockage Due to Fouling

As amended by letter dated January 15, 2015, LRA Table 3.3.1, item 3.3.1-131, addresses carbon steel piping exposed to an air-indoor (internal) environment, which will be managed for flow blockage due to fouling. For the AMR item that cites generic note E, the LRA credits the PSPM Program to manage this aging effect. The GALL Report recommends 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,” to ensure that this aging effect is adequately managed. GALL Report AMP XI.M27 recommends using periodic visual inspections to manage the effects of aging.

The staff’s evaluation of the applicant’s PSPM Program is documented in SER Section 3.0.3.3.1. The staff’s evaluation of the use of the PSPM Program to manage flow blockage due to fouling for the carbon steel piping exposed to an air-indoor (internal) environment in the fire protection water system is documented in SER Section 3.0.3.2.10 in the staff’s evaluation of the response to RAI B.1.19-1.

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).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation Is Recommended

In LRA Section 3.3.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the auxiliary system components and provides 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 states that where fatigue is identified as an AERM for piping, and piping for components designed to ASME Code requirements, or for plant cranes and girders designed to CMAA-70 requirements, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1). Evaluations of these TLAAs are addressed in LRA Sections 4.3 and 4.7.

LRA Section 3.3.2.2.1, associated with LRA Table 3.3.1, item 3.3.1-1, addresses steel cranes and girders exposed to an air-indoor uncontrolled environment, which will be managed for cumulative fatigue damage or cracking induced by fatigue. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the assessment of cumulative fatigue damage or cracking by fatigue in the associated reactor building crane is a TLAA, as defined in 10 CFR 54.3. The applicant stated that the applicable TLAA is evaluated in accordance with 10 CFR 54.21(c)(1) and is addressed in LRA Section 4.7.7.

LRA Section 3.3.2.2.1, associated with LRA Table 3.3.1, item 3.3.1-2, addresses steel and stainless steel piping, piping components, piping elements, heat exchanger components, and heat exchanger tubes exposed to treated borated water, treated water, or an air-indoor uncontrolled environment, which will be managed for cumulative fatigue damage or cracking induced by fatigue (i.e., aging effects induced by cyclical loading). The applicant addressed the further evaluation criteria of the SRP-LR by stating that assessment of fatigue in these components is a TLAA, as defined in 10 CFR 54.3. The applicant stated that the applicable TLAA is evaluated in accordance with 10 CFR 54.21(c)(1) and is addressed in LRA Section 4.3.

By letter dated May 9, 2016, the applicant amended the LRA to include two new AMR items for steel piping, piping components, and valve bodies in the BDBEE mitigation (Fukushima) system. The new AMR items, associated with LRA Table 3.2.1-1, item 3.2.1-1, address steel piping, piping components, and valve bodies exposed to an internal treated water environment, which will be managed for cumulative fatigue damage or cracking due to fatigue. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the assessment of fatigue in these components is a TLAA, as defined in 10 CFR 54.3. The applicant stated that the applicable TLAA is evaluated in accordance with 10 CFR 54.21(c)(1) and is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.3.2.2.1 against the criteria in SRP-LR Section 3.3.2.2.1, which state that cumulative fatigue damage or cracking due to fatigue of these components is a TLAA and must be evaluated in accordance with the TLAA acceptance criteria requirements of

10 CFR 54.21(c). The staff reviewed the applicant's AMR line items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage in these components. The staff verified that the applicable metal fatigue TLAA for the Non-Class 1 auxiliary system components is given in LRA Section 4.3.2, "Non-Class 1 Fatigue Analyses," and that the applicable cyclical loading TLAA for the reactor building crane is given in LRA Section 4.7.7, "Crane (Heavy Load) Cycles."

Based on its review, the staff concludes that the applicant has met the SRP-LR Section 3.3.2.2.1 criteria. For those line items that apply to LRA Section 3.3.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff's evaluation of the metal fatigue analyses for these auxiliary system components is documented in SER Section 4.3.2, "Non-Class 1 Fatigue Analyses." The staff's evaluation of the cyclical loading analysis for the reactor building crane is documented in SER Section 4.7.7, "Crane (Heavy Load) Cycles."

3.3.2.2.2 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

LRA Section 3.3.2.2.2 is associated with LRA Table 3.3.1, item 3.3.1-3, and addresses cracking due to SCC and cyclic loading in stainless steel nonregenerative heat exchanger components exposed to treated borated water in PWR chemical and volume control systems. The applicant stated that this item is not applicable because it pertains to PWR nonregenerative heat exchanger components. The staff evaluated the applicant's claim and finds it acceptable because this item only applies to PWRs.

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 state 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 will be managed by the External Surfaces Monitoring Program. The applicant also stated that there are no indoor stainless steel auxiliary system components located near outdoor air intakes that could also be subject to this aging effect.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The program includes an enhancement to revise procedures to ensure that walkdowns inspect for leakage to detect cracking in stainless steel components exposed to air containing halides. However, several AMR items associated with item 3.3.1-4 have a gaseous internal environment. As a result, it was unclear to the staff how walkdowns of external surfaces will effectively use leakage as an indicator of cracking. By letter dated December 19, 2014, the staff issued RAI B.1.16-1, requesting that the applicant state the parameters inspected and the inspection method(s) that it will use to determine whether cracking is present on the gas-filled outdoor components. The staff's evaluation of the response to RAI B.1.16-1 is documented in SER Section 3.0.3.2.7.

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 that its proposal to manage the effects of aging using the External Surfaces Monitoring Program is acceptable because visual inspections and augmenting visual inspections by using techniques, such as soap bubbles and trending performance data, are methods capable of detecting cracking before loss of intended function, as documented in SER Section 3.0.3.2.7.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.3.2.2.3 criteria. For those items associated with LRA Section 3.3.2.2.3, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Loss of Material Due to Cladding Breach

LRA Section 3.3.2.2.4, associated with LRA Table 3.3.1, item 3.3.1-5, addresses loss of material due to cladding breach in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The applicant stated that this item is not applicable because it only applies to PWRs. The staff confirmed that this item is associated only with PWR plants; therefore, the staff finds the applicant's determination acceptable.

3.3.2.2.5 Loss of Material Due to Pitting and Crevice Corrosion

LRA Section 3.3.2.2.5, associated with LRA Table 3.3.1, item 3.3.1-6, addresses 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 will be managed by the External Surfaces Monitoring Program. The applicant also stated that there are no indoor stainless steel auxiliary system components located near outdoor air intakes that could also be subject to this aging effect.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The staff noted that the applicant's program includes periodic visual inspections of external surfaces, which are 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 that its 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 before 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 for 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 wastewater, which will be managed for loss of material due to recurring internal corrosion by the PSPM Program. 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 an operating experience search for repeated instances where an aging effect resulted in a component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent. The applicant addressed the further evaluation criteria of the SRP-LR by stating that recurring internal corrosion was identified in carbon steel piping components exposed to raw water in the auxiliary systems. The applicant also stated that this aging effect will be managed with the PSPM Program by monitoring wall thickness at selected locations and by replacing pipe where necessary.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The program includes periodic wall thickness measurement at selected locations based on pipe configuration, flow conditions, and operating history. A minimum of five inspections of carbon steel piping exposed to raw water will be performed each year until the rate of recurring internal corrosion occurrences no longer meets the operating experience criteria in the further evaluation that prompted the augmented inspections.

In its review of components associated with item 3.3.1-127, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the PSPM Program is acceptable because the applicant's proposal increases the minimum number and frequency of inspections beyond those recommended by the GALL Report such that recurring corrosion can be effectively monitored before a loss of intended function. The GALL Report program to manage the internal surfaces of piping in raw water (outside of the fire protection and safety-related service water systems), GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," recommends the inspection of a maximum of 25 locations in each 10-year period, with no provision to perform inspections every year. In contrast, the applicant proposes to examine a minimum of 50 locations in each 10-year period, with inspections occurring each year.

Based on the program identified, the staff determines that the applicant's program meets the criteria in SRP-LR Section 3.3.2.2.8. For those items associated with LRA Section 3.3.2.2.8, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

For LRA Tables 3.3.2-1 through 3.3.2-17-36, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-17-36, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations 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.

3.3.2.3.1 Control Rod Drive System – Summary of Aging Management Evaluation – LRA Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the CRD 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 CRD system component groups are consistent with the GALL Report.

3.3.2.3.2 Standby Liquid Control System – Summary of Aging Management Review – LRA Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the standby liquid control system component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the standby liquid control system component groups are consistent with the GALL Report.

3.3.2.3.3 Service Water Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the service water systems component groups.

Carbon Steel and Stainless Steel Piping, Piping Components Heat Exchanger Components and Tanks Exposed to Treated Water, Raw Water, Lubricating Oil, and Fuel Oil. As amended by letter dated February 15, 2015, LRA Tables 3.3.2-3, 3.3.2-7, 3.3.2-10, 3.3.2-15, 3.3.2-17-5, 3.3.2-17-15, and 3.3.2-17-28 state that carbon steel and stainless steel piping, piping components, heat exchanger components, and tanks exposed to treated water, raw water, lubricating oil, and fuel oil will be managed for loss of coating integrity by the Coating Integrity Program. The AMR items cite generic note H.

The staff noted that, although the applicant cited generic note H, 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," provides AMR line items to address this MEAP combination. SRP-LR Table 3.3 1, item 3.3.1-138, states that metallic piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to raw water, treated water, lubricating oil, or fuel oil are managed for loss of coating integrity by GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.

The staff's evaluation of the applicant's Coating Integrity Program is documented in SER Section 3.0.3.2.24. The staff finds the applicant's proposal to manage the effects of aging using the Coating Integrity Program acceptable because periodic visual inspections of internal coatings by qualified personnel are capable of detecting loss of coating integrity.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Condensation (External). In LRA Tables 3.2.2-8-1, 3.3.2-3, 3.3.2-5, 3.3.2-10, 3.3.2-11, 3.3.2-12, 3.3.2-17-16, 3.3.2-17-17, and 3.3.2-17-28, the applicant stated that carbon steel and stainless steel closure bolting exposed to condensation (external) will be managed for loss of preload by the Bolting Integrity Program. The AMR items cite plant-specific note H, which states that the aging effect is not in the GALL Report for this component, material, and environment combination.

However, the staff noted that this material and environment combination is identified in the GALL Report, which states that steel and stainless steel closure bolts exposed to uncontrolled indoor air (uncontrolled indoor air is an environment associated with systems with temperatures higher than the dew point, (i.e., condensation can occur, but only rarely)) are susceptible to loss of preload and loss of material. The GALL Report recommends GALL Report AMP XI.M18, "Bolting Integrity," to manage the aging effects for closure bolting. The applicant addressed the GALL Report identified aging effect of loss of material for this component, material, and environment combination in other AMR items in LRA Tables 3.3.2-3, 3.3.2-5, 3.3.2-10, 3.3.2-11, 3.3.2-12, 3.3.2-17-17, and 3.3.2-17-28.

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 Bolting Integrity Program proposes to manage the aging effect of loss of preload of closure bolting by performing periodic visual inspections of closure bolts and taking preventive actions, such as applying the appropriate preload and checking for uniformity of gasket compression to prevent loss of preload. The staff finds the applicant's proposal to manage loss of preload using the Bolting Integrity Program acceptable because, consistent with the GALL Report recommendations, the program includes periodic visual inspections capable of detecting loss of preload and preventive actions to minimize the potential for loss of preload before loss of intended function.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Raw Water (External). In LRA Tables 3.3.2-3, 3.3.2-7, and 3.3.2-10, the applicant stated that carbon steel and stainless steel closure bolting exposed to raw water will be managed for loss of material by the Bolting Integrity Program. The AMR items cite plant-specific note H, which states that the aging effect is not in the GALL Report for this component, material, and environment combination. However, the staff noted that this material and environment combination is identified in the GALL Report, which states that steel and stainless steel bolts exposed to raw water are susceptible to loss of material and loss of preload and recommends GALL Report AMP XI.M18, “Bolting Integrity,” to manage the aging effects. The applicant addressed the GALL Report identified aging effect of loss of material for this component, material, and environment combination in other AMR items in LRA Tables 3.3.2-7 and 3.3.2-10.

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 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. The staff also noted that a submerged (raw water) environment limits the ability to detect leakage of submerged bolted connections; therefore, the applicant’s explanation on how the program will detect loss of material before a loss of intended function was not clear. By letters dated December 19, 2014, and April 4, 2015, the staff issued RAIs B.1.2-2 and B.1.2-2a to address this issue. The issue is resolved and documented in SER Section 3.0.3.2.1. Based on its review of information provided in the applicant’s responses to RAIs B.1.2-2 and B.1.2-2a and revisions to LRA Sections A.1.2, A.4, and B.1.2, the staff noted that the Bolting Integrity Program proposes to manage the aging effect of loss of material for closure bolting submerged in raw water by performing the following activities:

- Taking preventive actions consistent with the GALL Report to minimize the potential of lubricant-related degradation.
- Performing visual inspections, at least once every RFO, of bolt head and exposed bolt threads to detect loss of material.
- Quarterly monitoring of pump performance, which can result in the detection of age-related degradation of the submerged bolting.
- Performing opportunistic inspections of the bolts, including the nonexposed area of the bolt threads, during pump maintenance activities.

The staff finds the applicant’s proposal to manage loss of material for closure bolts submerged in raw 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 before a loss of intended function.

<u>Stainless Steel Piping and Piping Components Exposed to Condensation</u>. The staff’s evaluation for stainless steel piping and piping components exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

<u>Elastomer Flex Connections Exposed to Outdoor Air</u>. In LRA Table 3.3.2-3, the applicant stated that elastomer flex connections exposed to outdoor air will be managed for changes in material properties, cracking, and loss of material due to wear 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 the credible aging effects for this component, material, and environment description. The GALL Report states that elastomeric components exposed to air environments are susceptible to increased hardness, shrinkage, loss of strength, and loss of material due to wear. Because the aging effects proposed by the applicant effectively describe those identified in 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 External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring Program acceptable because the program's periodic visual inspections and physical manipulation of elastomer external surfaces, which are conducted at least once per refueling cycle, are capable of detecting degradation of elastomer components by observations of cracking, scuffing, discoloration, and hardening.

<u>Elastomer Flex Connections Exposed to Gas, Condensation, Fuel Oil, Lubricating Oil, and Steam</u>. In LRA Tables 3.3.2-3, 3.3.2-6, 3.3.2-9, and 3.4.2-3-5, the applicant stated that elastomer flex connections exposed to gas, condensation, fuel oil, lubricating oil, and steam will be managed for cracking and changes in material properties 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 the credible aging effects for this component, material, and environment description. GALL Report Table IX.E, as revised by LR-ISG-2012-02, states that elastomers can experience increased hardness, shrinkage, loss of sealing, cracking, and loss of strength. GALL Report AMR items also cite the aging effects of hardening and loss of strength for elastomer components in air and water environments. Because the aging effects proposed by the applicant effectively describe those identified in 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 Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.11. The program includes both visual inspections and physical manipulation or pressurization to characterize elastomer degradation. 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 and physical manipulation conducted by the program, with a representative sample of components inspected at least once every 10 years, are capable of detecting cracking and changes in material properties of elastomer components by observations of cracking, other surface discontinuities, discoloration, and hardening.

<u>Carbon Steel Piping Exposed to Raw Water</u>. As amended by letter dated June 9, 2015, LRA Table 3.3.2-3 states that carbon steel piping exposed to raw water will be managed for loss of coating integrity by the Service Water Integrity Program. The AMR item cites generic note H and plant-specific note 312. Plant-specific note 312 states that "[t]he One-Time Inspection Program will supplement the Service Water Integrity Program for the galvanized piping in the mechanical draft cooling tower spray assemblies."

The staff noted that, although the applicant cited generic note H, 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," provides an AMR line item to address this MEAP combination. SRP-LR Table 3.3-1, item 3.3.1-138, states that metallic piping with internal coatings exposed to raw water are managed for loss of coating integrity by GALL Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.”

The applicant removed the MDCT spray assemblies from the scope of the Coating Integrity Program and proposed to use the Service Water Integrity and One-Time Inspection programs to manage loss of coating integrity for these components. The staff’s evaluation of the applicant’s proposal to use the Service Water Integrity and One-Time Inspection programs to manage loss of coating integrity for these components is documented in SER Section 3.0.3.2.24. The staff finds the applicant’s proposal to manage the effects of aging using the Service Water Integrity and One-Time Inspection programs acceptable because periodic flow tests and one-time wall thickness measurements, with a criterion to conduct periodic wall thickness measurements if necessary, are capable of detecting loss of coating integrity.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-3 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.4 Fuel Pool Cooling and Cleanup System – Summary of Aging Management Review – LRA Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the fuel pool cooling and cleanup system component groups. The staff’s review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the fuel pool cooling and cleanup system component groups are consistent with the GALL Report.

3.3.2.3.5 Emergency Equipment Cooling Water System – Summary of Aging Management Review – LRA Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the emergency equipment cooling water system component groups.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Condensation (External). The staff’s evaluation for carbon steel and stainless steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Nickel Alloy Flexible Connections Exposed to Treated Water. In LRA Table 3.3.2-5, the applicant stated that nickel alloy flex connections exposed to treated water (internal) will be managed for loss of material by the Water Chemistry Control – Closed Treated Water Systems Program. The AMR item cites generic note G. LRA Table 3.3.2-5 also states that cracking due to fatigue is a TLAA. The AMR item cites generic note H. The staff’s review of TLAAs is discussed in SER Section 4.2.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. The staff notes that the applicant addressed cracking due to fatigue for this component, material, and environment combination in other AMR items in LRA

Table 3.3.2-5. Based on its review of GALL Report Table VIII.B1, which states that stainless steel components exposed to treated water can experience loss of material due to pitting and crevice corrosion, the staff believes that corrosion of nickel alloy would be very similar (i.e., both alloy systems could be susceptible to loss of materials due to crevice and pitting corrosion). Therefore, the staff finds that the aging effects proposed by the applicant conservatively describe those essentially identified in the GALL Report and that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Water Chemistry Control – Closed Treated Water Systems Program is documented in SER Section 3.0.3.2.23. The program includes both inspections and control of water chemistry to mitigate the effects of corrosion. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control – Closed Treated Water Systems Program acceptable because the inspections are capable of detecting loss of material if it is occurring, whereas the control of water chemistry will mitigate the effects of corrosion.

<u>Stainless Steel Piping and Piping Components and Nickel Alloy Flex Connections Exposed to Condensation</u>. The staff's evaluation for stainless steel piping and piping components and nickel alloy flex connections exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

<u>Nickel, Steel, and Stainless Steel Flex Connections Exposed to Treated Water</u>. In LRA Table 3.3.2-5, the applicant stated that there are TLAAs for nickel, steel, and stainless steel flex connections exposed to treated water that cite generic note H. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.2, for these components and materials. The staff's evaluation of the fatigue TLAAs for non-Class 1 components, other than piping, is documented in SER Section 4.3.3.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-5 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.6 Compressed Air Systems – 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 compressed air systems component groups.

<u>Nickel Alloy Flex Connector Exposed to Internal Condensation</u>. In LRA Table 3.3.2-6, the applicant stated that nickel alloy flex connectors exposed to internal condensation will be managed for loss of material by the Compressed Air Monitoring Program. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. For nickel alloy, cracking is a potential aging effect in high-temperature, highly caustic solutions (ASM International's *Metals Handbook*). Because the nickel alloy flex connectors are not exposed to such an environment, cracking is not a credible aging effect. Based on the above, the staff finds that the applicant has identified all credible aging effects for these component, material, and environment combinations.

The staff's evaluation of the applicant's Compressed Air Monitoring Program is documented in SER Section 3.0.3.2.4. The staff finds the applicant's proposal to manage the loss of material using the Compressed Air Monitoring Program acceptable because the Compressed Air Monitoring Program prevents moisture and contaminants from occurring within the system by monitoring the air quality. In addition, periodic internal visual inspections of critical components are performed to detect signs of corrosion.

Elastomer Flex Connections Exposed to Condensation. The staff's evaluation for elastomer flex connections exposed to condensation, which will be managed for cracking and changes in material properties by the Internal Surfaces in Miscellaneous Piping and Ducting Component Program and are associated with generic note G, is documented in Section 3.3.2.3.3.

Aluminum, Copper Alloy, Copper Alloy with Greater Than 15 percent Zinc (inhibited), and Stainless Steel Heat Exchanger Fins and Tubes Exposed to Indoor Air, Outdoor Air, and Condensation. In LRA Tables 3.3.2-6, 3.3.2-10, 3.3.2-11, and 3.3.2-12, the applicant stated that aluminum, copper alloy, copper alloy with greater than 15 percent zinc (inhibited), and stainless steel heat exchanger fins and tubes exposed to indoor air, outdoor 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.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. For the subject heat exchanger fins and tubes that were cited as having a pressure boundary intended function (in addition to heat transfer), the applicant addressed loss of material in other AMR items in LRA Tables 3.3.2-6, 3.3.2-11, and 3.3.2-12. The LRA did not address loss of material for the subject heat exchanger fins and tubes that were cited as having only a heat transfer intended function. Nevertheless, for the one subject component in which loss of material may occur (copper alloy tubes exposed to condensation in LRA Table 3.3.2-11), the visual inspections for fouling conducted by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program are capable of identifying loss of material before the heat transfer function of the fins and tubes are challenged. 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 3.0.3.1.11. 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 before loss of the intended function.

Steel and Stainless Steel Piping, Valve Bodies, and Flex Connections Exposed to Condensation. In LRA Table 3.3.2-6 the applicant stated that there are TLAAs for steel and stainless steel piping, valve bodies, and flex connections exposed to condensation that cite generic note H. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3, for these components and materials. The staff's evaluation of the fatigue TLAAs for piping, valve bodies, and flex connections is documented in SER Sections 4.3.1 and 4.3.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-6 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.7 Fire Protection – Water System – Summary of Aging Management Review – LRA Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the fire protection – water system component groups.

Carbon Steel and Stainless Steel Piping, Piping Components, Heat Exchanger Components, and Tanks Exposed to Treated Water, Raw Water, Lubricating Oil, and Fuel Oil. The staff's evaluation for carbon steel and stainless steel piping, piping components, heat exchanger components, and tanks exposed to treated water, raw water, lubricating oil, and fuel oil, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel Closure Bolting Exposed to Raw Water (External). The staff's evaluation for stainless steel closure bolting exposed to raw water (external), which will be managed for loss of material by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Steel Piping Exposed to Exhaust Gas. In LRA Table 3.3.2-7 the applicant stated that there is a TLAA for steel piping exposed to exhaust gas that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.1, for this component and material. The staff's evaluation of the fatigue TLAA for Class 1 piping is documented in SER Section 4.3.1.6.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-7 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.8 Fire Protection – CO_2 and Halon System – Summary of Aging Management Review – LRA Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the fire protection – CO_2 and halon system component groups.

Teflon® Flex Connections Exposed to Indoor Air and Gas. In LRA Table 3.3.2-8, the applicant stated that, for Teflon® flex connections exposed externally to indoor air and internally to gas, there is no aging effect and no proposed AMP. The AMR items cite 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 environmental combination. Based on its review, the staff identified the following potential environmental factors that could result in age-related degradation:

- Table 1 of National Aeronautics and Space Administration Technical Memorandum 105753, "High Temperature Dielectric Properties of Apical, Kapton, Peek, Teflon® AF, and Upilex Polymers," A.N. Hammoud, dated 1992, states that Teflon® can handle long-term temperatures up to 285 degrees Celsius (°C); however, there are studies that demonstrate that certain grades of Teflon® degrade when exposed to radiation.

- *PTFE [Teflon®] Expansion Joint Engineering Guide*, 2200, Ethylene LLC, Kentwood, MI, www.ethylene.com, accessed on October 20, 2014, states that the service life of Teflon® flexible connections will be reduced if it is subject to scratching, abrasion, and weld splatter.
- *DuPont Teflon® PTFE Fluoropolymer Resin Properties Handbook*, http://www.rjchase.com/ptfe_handbook.pdf, accessed on October 20, 2014, states that Teflon®-based products are susceptible to creep.

The staff lacked sufficient information to conclude that the radiation levels are low enough in the vicinity of the flex connections. In addition, although external scratching, abrasion, and weld splatter could be considered as event driven, these mechanisms can occur in the power plant environment as a matter of course. Further, the staff lacks sufficient information to conclude that, with creep, the material will retain sufficient material properties throughout the period of extended operation. By letter dated December 17, 2014, the staff issued RAI 3.3.2.3.8-1, requesting that the applicant (a) state the specific Teflon® material type for these flexible connections, (b) state the basis for why there is no AERM and no proposed AMP, and (c) explain how the aging effects will be managed if the specific Teflon® material type does age.

In its response dated January 15, 2015, the applicant stated that (a) the expected cumulative radiation exposure for these components is less than 10^4 rads, (b) the Teflon® material is contained within a stainless steel wire braid cover and, therefore, is not susceptible to scratching, abrasion, and weld splatter, and (c) the flex connections are not normally pressurized and, therefore, are not susceptible to creep.

The staff noted that NRC IN 2014-04, "Potential for Teflon® Material Degradation in Containment Penetrations, Mechanical Seals and Other Components," dated March 26, 2014, cites the Westinghouse Electric Company report entitled, "AP1000® Design Control Document," Revision 19, Tier 2 Chapter 3, Appendix 3D, "Methodology for Qualifying AP1000 Safety-Related Electrical and Mechanical Equipment." The Westinghouse Electric Company document states that, "for a gamma dose of less than 10^4 rads, there are no observable radiation effects that impact material mechanical properties."

The staff reviewed several commercial websites on January 29, 2015, http://navyaviation.tpub.com/14018/css/14018_228.htm, http://www.titeflex.com/industrial/products/PTFE/index.html, http://www.herberaircraft.com/pdf/Hoses%20tech%20broch(new)/Teflon%20Hoses/666%20Crimp%20Fittings%20eng%20bulletin.PDF. These websites state that Teflon® (PTFE) hose assemblies do not have shelf-life limitations, PTFE is chemically inert, it will not break down or deteriorate in service, and the service- and shelf-life of a Teflon® hose is unlimited for all practical purposes. The staff noted that Licensee Event Report (LER) 285/2012-002-01, "Inadequate Qualifications for Containment Penetrations Renders Containment Inoperable," dated July 2, 2013 (ADAMS Accession No. ML13184A270), documents physical testing of electrical penetration assemblies with Teflon® seals and Teflon®-insulated conductors conducted between November 2012 and February 2013. The penetration assemblies had been in service for 39 years. The testing consisted of exposing the assembly to additional irradiation and then exposing the assemblies to a design basis accident test profile. The Teflon® seals passed helium leak test criteria. Based on its review of these references, the staff concluded that Teflon® flex connections exposed externally to indoor air and internally to gas are not subject to an AERM as long as the components environmental conditions (e.g., temperature and exposure) are not beyond threshold values for Teflon®.

The staff finds the applicant's response and proposal that there are no AERMs acceptable because (a) Teflon® has a radiation exposure threshold higher than the cumulative dose to which the components will be exposed, (b) Teflon® has a temperature exposure threshold much higher than what the components would be exposed to in the CO_2 and halon system, (c) the Teflon® material is protected from scratching, abrasion, and weld splatter by the stainless steel braided covering, and (d) the material is not pressurized and it is designed as a flexible connections and is, therefore, not subject to creep. In addition, based on a review of GALL Report, item AP-23, there are no AERMs for stainless steel piping components exposed to indoor air. The staff's concern described in RAI 3.3.2.3.8-1 is resolved.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-8 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.9 Combustion Turbine Generator – Summary of Aging Management Evaluation – LRA Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the combustion turbine generator system component groups.

Glass and Stainless Steel Filters Exposed to Indoor Air. In LRA Table 3.3.2-9, the applicant stated that glass and stainless steel filters exposed to indoor air will be managed for fouling by the PSPM 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 glass and stainless steel exposed to indoor air are not susceptible to any aging effects. However, the applicant has identified fouling as an aging effect for filters that have an intended function of filtration.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The applicant's program includes periodic visual inspections and cleaning of the atomizing air booster compressor suction filter and the compressor extraction air filter in the combustion turbine generator system. These activities are performed at least once every 5 years to manage fouling. The staff finds the applicant's proposal to manage the effects of aging using the PSPM Program acceptable because periodic visual inspections and cleaning can ensure that the filtration function of the subject components are maintained.

Copper Alloy Heat Exchanger Tubes Exposed to Indoor Air. In LRA Table 3.3.2-9, the applicant stated that copper alloy heat exchanger tubes exposed to indoor air will be managed for fouling and loss of material due to wear by the PSPM Program. The AMR items cite generic notes G (fouling) and H (loss of material).

The staff noted that this material and environment combination is identified in the GALL Report, which states that copper alloy exposed to uncontrolled indoor air is not susceptible to any aging effects. However, the applicant has identified fouling and loss of material due to wear as aging effects on the external surfaces of heat exchanger tubes.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The applicant's program includes periodic visual inspections of a representative sample of atomizing air precooler heat exchanger tubes to manage fouling and loss of material due to wear. The representative sample is inspected at least once every 5 years. The staff finds the applicant's proposal to manage the effects of aging using the PSPM Program acceptable because periodic visual inspections of a sample of the heat exchanger tube external surfaces is capable of identifying fouling and wear before loss of intended function.

Copper Alloy with Greater than 15 percent Zinc Heat Exchanger Tubes Exposed to Lubricating Oil and Treated Water. In LRA Tables 3.3.2-9 and 3.3.2-10, the applicant stated that copper alloy with greater than 15 percent zinc heat exchanger tubes exposed to lubricating oil and closed treated water will be managed for loss of material due to wear by the PSPM Program. The AMR items cite generic note H.

The staff noted that these material and environment combinations are identified in the GALL Report, which states that copper alloy heat exchanger tubes exposed to lubricating oil and closed treated water are susceptible to fouling and loss of material due to corrosion and which recommends GALL Report AMPs XI.M39, "Lubricating Oil Analysis," and XI.M32, "One-Time Inspection" to manage the aging effects in the lubricating oil environment and GALL Report AMP XI.M21A, "Closed Treated Water Systems," to manage the aging effects in the closed treated water environment. However, the applicant has identified loss of material due to wear 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 3.3.2-9 and 3.3.2-10.

The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The applicant's program includes periodic visual inspections of a representative sample of lubricating oil and jacket water (closed treated water) heat exchanger tubes to manage loss of material due to wear. The representative sample is inspected at least once every 5 years. The staff finds the applicant's proposal to manage the effects of aging using the PSPM Program acceptable because periodic visual inspections of a sample of the heat exchanger tube external surfaces is capable of identifying wear before loss of intended function.

Carbon Steel Closure Bolting Exposed to Lube Oil (External). In LRA Tables 3.3.2-9 and 3.3.2-12 the applicant stated that carbon steel closure bolting exposed to lube oil (external) will be managed for loss of material and loss of preload by the Bolting Integrity Program. The AMR items cite generic note G, which states that the environment is not in the GALL Report for this component and material combination.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report, which recommends that steel components (other than heat exchangers) exposed to lubricating oil be managed for loss of material and that closure steel bolts (that are not made of high strength steel) be managed for loss of material and 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, consistent with the GALL Report AMP XI.M18 recommendations, the Bolting Integrity Program includes preventive measures, such as proper torqueing of bolts and checking for uniformity of gasket compression to minimize loss of preload.

GALL Report AMP XI.M18 also 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 LRA states that the bolts were exposed to a lube oil (exterior) environment. Based on the LRA description of the lube oil (exterior) environment, it was not clear whether the bolts in a lube oil (exterior) environment were always submerged in lube oil. The staff was concerned that, if the bolts are always submerged in lube oil, the ability to detect leakage in the submerged bolted connections would be limited. If leakage cannot be readily detected, the program would not be able to use leakage as an indicator of loss of material and loss of preload for submerged bolted connections before loss of intended function. By letter dated January 14, 2015, the staff issued RAI 3.3.2.9-1 requesting that the applicant state whether the closure bolts are submerged in lube oil and describe how the program will be capable of detecting loss of material and loss of preload for these bolts, including how the proposed bolting inspections will be capable of detecting loss of material in the threaded regions, below the bolt head, that are not readily visible.

In its response dated February 12, 2015, the applicant stated that the bolting is submerged in lubricating oil and located in lube oil pumps that are internal to a machine in a lube oil sump in the nonsafety-related combustion turbine generator system and safety-related control center HVAC system. The applicant clarified that these pumps are inaccessible during normal operation. The applicant noted that, due to the inaccessibility of the pumps, it is impractical to inspect the submerged bolting every RFO as recommended by GALL Report AMP XI.M18. Therefore, the applicant stated that an exception to the GALL Report recommended frequency of inspections will be taken for the inspection of these submerged bolts. The applicant also noted that Appendix C to EPRI TR-1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4,” dated January 2006, states that lubricating oil systems generally do not suffer appreciable degradation by cracking or loss of material because the environment is not conducive to corrosion mechanisms. In its response, the applicant also described the following activities to manage the aging effects of loss of material and loss of preload in the submerged closure bolting:

- To minimize the potential for loss of material and loss of preload, preventive measures that are consistent with the GALL Report AMP XI.M18 recommendations will be taken under the Bolting Integrity Program. The preventive actions consist of the selection of materials and lubricants, application of the appropriate preload, and checking for uniformity of gasket compression of closure bolting.
- The lube oil pump and associated submerged bolting in the control center HVAC system will be inspected during scheduled disassembly and inspection preventive maintenance events, which occur at an 8- to 10-year frequency. Bolting issues could result in indirect degradation of lube oil performance. During system operation, lube oil pressure is monitored, and degradation of lube oil performance will be identified, entered into the corrective action program, and may result in pump repair or refurbishment. The associated bolting, including the bolting threads, will be inspected during these maintenance activities to ensure that loss of material in the thread area of the bolt will be detected.
- The lube oil pump in the combustion turbine generator system has a good performance record and no performance maintenance events are scheduled. This lube oil pump and associated submerged closure bolting will be subject to opportunistic inspections

(e.g., whenever the lube oil sump is drained). During system operation, lube oil pressure is monitored, and degradation of lube oil performance will be identified, entered into the Corrective Action Program, and may result in pump repair or refurbishment.

The staff notes that, as part of its response to RAI 3.3.2.9-1, the applicant also revised LRA Sections A.1.2, and B.1.2 to incorporate new exceptions, enhancements, and commitments to the Bolting Integrity Program. The staff's review of the exceptions, enhancements, and commitments related to the Bolting Integrity Program is documented in SER Section 3.0.3.2.1. The staff noted that the information cited by the applicant from Appendix C of EPRI TR-1010639 is consistent with the GALL Report guidance, which states that steel, when exposed to lubricating oil with some water, will have limited susceptibility to aging degradation due to general or localized corrosion. The staff needed clarification on whether the environment to which the closure bolts were exposed was always lube oil or whether the bolts were exposed during prolonged periods to a water environment that could cause them to be susceptible to accelerated corrosion. In addition, based on the applicant's statement that lube oil pressure is monitored and that degradation of lube oil performance could be identified and could lead to corrective actions, the frequency at which the pressure is monitored such that corrective actions would be taken before the loss of intended function of the bolts was unclear. The staff needed this information in consideration of the fact that the program does not include periodic visual inspections to detect the loss of material and loss of preload for submerged bolted connections. Therefore, in a telephone conference call held in March 6, 2015, the staff requested clarification on the RAI response regarding whether the closure bolts were always exposed to a lube oil submerged environment or whether there were periods in which they were exposed to a water environment. The staff also requested clarification on how often the applicant monitors the lube oil pressure of the pumps. The applicant stated that, other than during maintenance activities, the bolts were always exposed to a lube oil environment. The applicant stated that maintenance activities are performed once every 8 years. The applicant also stated that, for the pump in the control center HVAC system, the lube oil pressure is monitored during startup of the pump and approximately once every 12 hours every day. For the pump in the combustion turbine generator system, the lube oil pressure is monitored once a month when the pump is running.

The staff finds the applicant's response to RAI 3.3.2.9-1 and its proposal to manage the aging effects using the Bolting Integrity Program acceptable because of the following:

- The applicant provided additional information describing the environment and clarifying that the closure bolts are submerged in lubricating oil and that, as stated in the GALL Report, steel components exposed to lubricating oil with some water have limited susceptibility to aging degradation.
- The Bolting Integrity Program has preventive measures in place that are consistent with GALL Report AMP XI.M18 to prevent loss of material and loss of preload.
- The submerged closure bolts will be subject to opportunistic visual inspections under the Bolting Integrity Program.
- The preventive actions taken and opportunistic inspections to be performed under the Bolting Integrity Program in combination with the periodic monitoring of the lube oil pressure (every 12 hours for the control center HVAC system pump and once a month for the combustion turbine generator system pump) provide reasonable assurance that degradation associated with the submerged bolts will be identified, and corrective actions will be taken, before there is a loss of the intended function.

The staff's concerns described in RAI 3.3.2.9-1 are resolved.

Aluminum and Copper Alloy Heat Exchanger Components Exposed to Outdoor Air. The staff's evaluation for aluminum heat exchanger fins and copper alloy heat exchanger tubes exposed to outdoor air, which will be managed for fouling by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.4.

Carbon Steel Housings and Screens Exposed to Outdoor Air. In LRA Table 3.3.2-9, the applicant stated that the internal surfaces of carbon steel housing and screens 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 note 304, which states that "because the internal and external surfaces are exposed to the same environments, aging effects of the internal surfaces can be inferred from external surface conditions."

The staff reviewed the associated items in the LRA and considered whether the aging effect proposed by the applicant constitutes all the credible aging effects for this component, material, and environment description. The GALL Report states that steel is only susceptible to loss of material in outdoor air. 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 External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The GALL Report states that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," may be credited with managing the aging of internal surfaces when the material and environment combinations of the internal and external surfaces are the same. 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 any degradation of the internal surfaces will be identified before loss of the intended function.

Elastomer Flex Connections Exposed to Fuel Oil and Lubricating Oil. The staff's evaluation for elastomer flex connections exposed to fuel oil and lubricating oil, which will be managed for cracking and changes in material properties by the Internal Surfaces in Miscellaneous Piping and Ducting Component Program and are associated with generic note G, is documented in Section 3.3.2.3.3.

Carbon Steel, Copper Alloy, and Stainless Steel Piping Components, Heat Exchanger Components, and Condenser Housings Exposed to Outdoor Air. In LRA Tables 3.3.2-9, 3.3.2-11, and 3.3.2-15, the applicant stated that carbon steel, copper alloy, and stainless steel piping components, heat exchanger components, and condenser housings exposed to outdoor air will be managed for loss of material 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 effect proposed by the applicant constitutes all the credible aging effects for this component, material, and environment description. The applicant addressed fouling of copper alloy heat exchanger tubes in another AMR item in LRA Table 3.3.2-11. The applicant did not cite any additional aging effects for the other subject components. The GALL Report states that steel and copper alloys are only susceptible to loss of material in outdoor air. The GALL Report also states that stainless steel is susceptible to cracking when exposed to outdoor air with chloride contamination. LRA Table 3.3.2-15 contains AMR items for stainless steel sight glasses exposed to outdoor air in the fuel oil systems, and cracking was not cited as an aging effect for these components. However, as described in UFSAR Sections 7.5.2.5.2, 9.5.1, and 9.5.2, because the fuel oil systems are sheltered from direct exposure to the outdoor air environment, chloride contamination of the site glasses is not expected to occur. 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 3.0.3.1.11. 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 before loss of the intended function.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-9 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.10 Emergency Diesel Generator System – Summary of Aging Management Review – LRA Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the EDG system component groups.

Carbon Steel and Stainless Steel Piping, Piping Components, Heat Exchanger Components, and Tanks Exposed to Treated Water, Raw Water, Lubricating Oil, and Fuel Oil. The staff's evaluation for carbon steel and stainless steel piping, piping components, heat exchanger components, and tanks exposed to treated water, raw water, lubricating oil, and fuel oil, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.3.2.3.3.

Copper Alloy with Greater Than 15 Percent Zinc Heat Exchanger Tubes Exposed to Lubricating Oil and Treated Water. The staff's evaluation for copper alloy with greater than 15 percent zinc heat exchanger tubes exposed to lubricating oil and closed treated water, which will be managed for loss of material due to wear by the PSPM Program and are associated with generic note H, is documented in SER Section 3.3.2.3.9.

Carbon Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Carbon Steel Closure Bolting Exposed to Raw Water (External). The staff's evaluation for carbon steel closure bolting exposed to raw water (external), which will be managed for loss of material by the Bolting Integrity Program and which is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel Piping Components Exposed to Condensation. The staff's evaluation for stainless steel piping components exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

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 tube 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 SER Section 3.3.2.3.6.

Steel and Stainless Steel Piping and Expansion Joints Exposed to Exhaust Gas. In LRA Table 3.3.2-10, the applicant stated that there are TLAAs for steel and stainless steel piping and expansion joints exposed to exhaust gas that cite generic note H. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.2, for these components and materials. The staff's evaluation of the fatigue TLAAs for non-Class 1 components is documented in SER Sections 4.3.2.1 and 4.3.2.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-10 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.11 Heating, Ventilation, and Air Conditioning Systems – 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 HVAC systems component groups.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel and stainless steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Aluminum Filter Housings Exposed to Outdoor Air. In LRA Table 3.3.2-11, the applicant stated that aluminum filter housings exposed to outdoor air will be managed for cracking by the External Surfaces Monitoring 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 aluminum piping, piping components, and piping elements exposed to outdoor air are susceptible to loss of material and recommends GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," to manage the aging effect. However, the applicant has identified cracking as an additional aging effect for aluminum filter housings. The applicant addressed the GALL Report identified aging effect for this component, material, and environment combination in another AMR item in LRA Table 3.3.2-11.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," manages for cracking on external surfaces by identifying leakage of internal liquids. However, the aluminum filter housings have a gaseous internal environment. As a result, it was unclear to the staff how walkdowns of external surfaces will effectively use leakage as an indicator of cracking. By letter dated December 19, 2014, the staff issued

RAI B.1.16-1 requesting that the applicant state the parameters inspected and describe the inspection method(s) that will be used to determine whether cracking is present on gas-filled outdoor components. The staff's evaluation of the response to RAI B.1.16-1 is documented in SER Section 3.0.3.2.7.

In its review of components associated with LRA Table 3.3.2-11, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the External Surfaces Monitoring Program is acceptable because visual inspections and augmenting visual inspections by using techniques, such as soap bubbles and trending performance data, are methods capable of detecting cracking before loss of intended function, as documented in SER Section 3.0.3.2.7.

Aluminum, Copper Alloy, and Stainless Steel Heat Exchanger Fins and Tubes Exposed to Indoor Air, Outdoor Air, and Condensation. The staff's evaluation for aluminum, copper alloy, and stainless steel heat exchanger fins and tube exposed to indoor air, outdoor air, and 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 3.3.2.3.6.

Carbon Steel Housings and Copper Alloy Heat Exchanger Tubes Exposed to Outdoor Air. The staff's evaluation for carbon steel condenser and heat exchanger housings and copper alloy heat exchanger tubes exposed to outdoor air, which will be managed for loss of material by the Internal Surfaces in Miscellaneous Piping and Ducting Component Program and are associated with generic note G, is documented in Section 3.3.2.3.9.

Stainless Steel Heat Exchanger Components Exposed to Condensation. The staff's evaluation for stainless steel heat exchanger components exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-11 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.12 Control Center Heating, Ventilation, and Air Conditioning System – Summary of Aging Management Review – LRA Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the control center HVAC system component groups.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel and stainless steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Carbon Steel Closure Bolting Exposed to Lube Oil (External). The staff's evaluation for carbon steel closure bolting exposed to lube oil (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note G, is documented in SER Section 3.3.2.3.9.

Stainless Steel Piping Components Exposed to Condensation. The staff's evaluation for stainless steel piping components exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

Aluminum and Copper Alloy Heat Exchanger Fins and Tubes Exposed to Indoor Air and Condensation. The staff's evaluation for aluminum and copper alloy heat exchanger fins and tubes exposed to indoor air and 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 SER Section 3.3.2.3.6.

Fiberglass Moisture Separators Exposed to Indoor Air. In LRA Table 3.3.2-12, the applicant stated that, for fiberglass moisture separators exposed to indoor air, there is no aging effect and no AMP is proposed. The AMR items cite 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. NRC Regulatory Issue Summary 2012-02, "Insights into Recent License Renewal Application Consistency with the Generic Aging Lessons Learned Report," dated January 24, 2012, discusses several environmental factors that can degrade polymeric materials, including ultraviolet light, ozone, high temperatures, chemicals, and radiation. The staff finds the applicant's statement that there is no aging effect acceptable because the filters associated with the moisture separators in the control room HVAC system are not expected to be exposed to the above environmental stressors.

Graphite Rupture Discs Exposed to Indoor Air and Gas. In LRA Table 3.3.2-12, the applicant stated that, for graphite rupture discs exposed externally to indoor air and internally to gas, there is no aging effect and no proposed AMP. The AMR items cite generic note F.

During the audit, the staff reviewed plant-specific drawings and identified that the graphite rupture discs exposed externally to indoor air and internally to gas are Mersen Bursting Discs constructed of GRAPHILOR® material. The staff reviewed the supplier's website, https://www.mersen.com/en/products/anticorrosion-and-process-equipment/graphilor-bursting-discs.html, on October 20, 2014. The website states, "GRAPHILOR®, a resin impregnated graphite developed and patented by Mersen, is virtually impervious to most corrosive liquids and vapors within its temperature/pressure rating. GRAPHILOR® is a unique material insensitive to thermal shock." By letter dated December 17, 2014, the staff issued RAI 3.3.2.3.12-1, requesting that the applicant state the basis for not conducting inspections of the rupture disc material during the period of extended operation.

In its response dated January 15, 2015, the applicant stated that the rupture discs are routinely replaced every 8 years and, as a result, are not subject to an AMR. The applicant revised LRA Tables 2.3.3-12 and 3.3.2-12 and LRA Section 3.3.2.1.12 to remove the AMR line items.

The staff finds the applicant's response acceptable because items that are replaced on a periodic basis independent of condition monitoring are not subject to an AMR. In addition, based on the material being virtually impervious to most corrosive liquids and being insensitive to thermal shock, an 8-year replacement schedule provides reasonable assurance that the intended function(s) of the discs will be met during the period of extended operation. The staff's concern described in RAI 3.3.2.3.12-1 is resolved.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-12 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also concludes that, for items in this table with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.13 Containment Atmospheric Control Systems – 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 containment atmospheric control systems 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 containment atmospheric control systems component groups are consistent with the GALL Report.

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.

Copper Alloy Drain Exposed to Concrete. In LRA Table 3.3.2-14, the applicant stated that for copper alloy plant drains exposed to concrete (external surface), there is no aging effect and no AMP is proposed. The AMR item cites generic note G, which states that the environment is not addressed in the GALL Report for this material and component combination.

The staff reviewed the associated items in the LRA to confirm that there are no applicable aging effects for this component, material, and environmental combination. The staff finds the applicant's proposal acceptable based on its review of ASM *Handbook*, Volume 13B, "Corrosion: Materials," dated 2005, which states that copper alloys are corrosion resistant or corrode at negligible rates except when exposed to oxidizing acids, oxidizing heavy-metal salts, sulfur, ammonia, and some sulfur and ammonia compounds. Concrete, which is primarily composed of calcium, silicon, and oxide compounds, is not a corrosive environment for copper alloys. Additionally, the staff noted that the applicant will separately manage loss of material for these components, which are exposed to wastewater (internal surface), by performing visual inspections in accordance with the Internal Surfaces in Miscellaneous Piping and Ducting Components Program as described in SER Section 3.0.3.1.11.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-14 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.15 Fuel Oil Systems – Summary of Aging Management Review – LRA Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the fuel oil systems component groups.

Carbon Steel and Stainless Steel Piping, Piping Components, Heat Exchanger Components, and Tanks Exposed to Treated Water, Raw Water, Lubricating Oil, and Fuel Oil. The staff's evaluation for carbon steel and stainless steel piping, piping components, heat exchanger components, and tanks exposed to treated water, raw water, lubricating oil, and fuel oil, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel Site Glasses Exposed to Outdoor Air. The staff's evaluation for stainless steel site glasses exposed to outdoor air, which will be managed for loss of material by the Internal Surfaces in Miscellaneous Piping and Ducting Component Program and are associated with generic note G, is documented in SER Section 3.3.2.3.9.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-15 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.16 Primary Containment Monitoring and Leakage Detection Systems – Summary of Aging Management Review – LRA Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the primary containment monitoring and leakage systems component groups.

Stainless Steel Tubing, Valve Bodies, and Thermowells Exposed to Steam. In LRA Table 3.3.2-16, the applicant stated that there are TLAAs for stainless steel tubing, valve bodies, and thermowells exposed to steam which cite generic note H. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3, for these components and material. The staff's evaluation of the fatigue TLAAs for tubing, valve bodies, and thermowells is documented in SER Sections 4.3.1 and 4.3.2.

3.3.2.3.17 Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Evaluation – LRA Tables 3.3.2-17-1 through 3.3.2-17-37

The staff reviewed LRA Tables 3.3.2-17-1 through 3.3.2-17-37, which summarize the results of AMR evaluations for the miscellaneous auxiliary systems in scope for 10 CFR 54.4(a)(2) component groups.

CRD Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-1. The staff reviewed LRA Table 3.3.2-17-1, which summarizes the results of AMR evaluations for the CRD hydraulic system, nonsafety-related components affecting safety-related systems. 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 CRD hydraulic system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Standby Liquid Control System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-2. The staff reviewed LRA Table 3.3.2-17-2, which summarizes the results of AMR evaluations for the standby liquid control system, nonsafety-related components affecting safety-related systems. 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 standby liquid control system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Process Radiation Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-3.

Copper Alloy Sight Glasses Exposed to Wastewater. LRA Table 3.3.2-17-3 states that copper alloy (with greater than 15 percent zinc or 8 percent aluminum) sight glasses exposed internally to wastewater will be managed for loss of material by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR item references GALL Report, item AP-272. However, several GALL Report items, such as item AP-31, also state that components constructed of these copper alloys exposed to environments, including wastewater, may be susceptible to selective leaching. These items recommend GALL Report AMP XI.M33, "Selective Leaching" to ensure that this aging effect is adequately managed.

By letter dated December 4, 2014, the staff issued RAI 3.3.2.17.3-1 requesting that the applicant show that these copper alloy sight glasses are not susceptible to selective leaching or state how selective leaching will be managed for these components. In its response dated January 5, 2015, the applicant stated that the subject components are susceptible to loss of material due to selective leaching and added a new item to LRA Table 3.3.2-17-3 for copper alloy sight glasses exposed internally to wastewater. This new item also credits the Selective Leaching Program to manage loss of material and cites SRP-LR, item 3.3.1-72.

The staff finds the applicant's response acceptable because selective leaching will be managed in these components in a manner consistent with the GALL Report. The staff's concern described in RAI 3.3.2.17.3-1 is resolved.

Stainless Steel Piping, Piping Components, and Tanks Exposed to Condensation. The staff's evaluation for stainless steel piping, piping components, and tanks exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-3 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Radioactive Waste System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-4. The staff reviewed LRA Table 3.3.2-17-4, which summarizes the results of AMR evaluations for the radioactive waste system, nonsafety-related components affecting safety-related systems. 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 radioactive waste system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-5. The staff reviewed LRA Table 3.3.2-17-5, which summarizes the results of AMR evaluations for the reactor water cleanup system, nonsafety-related components affecting safety-related systems.

The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the reactor water cleanup system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-6. The staff reviewed LRA Table 3.3.2-17-6, which summarizes the results of AMR evaluations for the fuel pool cooling and cleanup system, nonsafety-related components affecting safety-related systems. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the fuel pool cooling and cleanup system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Torus Water Management System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-7. The staff reviewed LRA Table 3.3.2-17-7, which summarizes the results of AMR evaluations for the torus water management system, nonsafety-related components affecting safety-related systems. 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 torus water management system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Local Panels and Racks System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-8. The staff reviewed LRA Table 3.3.2-17-8, which summarizes the results of AMR evaluations for the local panels and racks system, nonsafety-related components affecting safety-related systems. 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 local panels and racks system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Off-Gas Process and Vacuum System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-9.

Stainless Steel Piping, Recombiner Components, and Valve Bodies Exposed to Steam. In LRA Tables 3.3.2-17-9, 3.3.2-17-28, and 3.3.2-17-33, the applicant stated that stainless steel piping, recombiner components, and valve bodies exposed to steam (internal) will be managed for cracking and loss of material by the Water Chemistry Control – Closed Treated Water Systems Program. The associated 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 the credible aging effects for this component, material, and environment description. The staff noted that the applicant also addressed loss of material and cracking due to fatigue for some of the components with the same material and environment combination in other AMR items in LRA Tables 3.3.2-17-9, 3.3.2-17-28, and 3.3.2-17-33. Based on its review of the GALL Report Table VIII, which states that stainless steel components exposed to steam can experience loss of material due to pitting and crevice corrosion and cracking due to SCC, the staff finds that the aging effects proposed by the applicant conservatively describe those identified in the GALL Report; therefore, the staff finds that the applicant has identified all the credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Water Chemistry Control – Closed Treated Water Systems Program is documented in SER Section 3.0.3.2.23. The program includes both inspections and control of water chemistry to mitigate the effects of corrosion. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control – Closed Treated Water Systems Program acceptable because the inspections are capable of detecting loss of material due to corrosion and cracking due to stress corrosion before loss of intended function, whereas control of water chemistry will mitigate the effects of corrosion and SCC.

Stainless Steel Piping Exposed to Steam. In LRA Table 3.3.2-17-9, the applicant stated that there is a TLAA for stainless steel piping exposed to steam that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAAs for non-Class 1 piping is documented in SER Section 4.3.2.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-9 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Potable Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-10.

Plastic Piping and Valve Bodies Exposed to Indoor Air. In LRA Tables 3.3.2-17-10 and 3.4.2-3-7, the applicant stated that plastic piping and valve bodies exposed to indoor air will be managed for change in material properties by the External Surfaces Monitoring Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. The GALL Report states that polyvinyl chloride (PVC) piping, piping components, and piping elements exposed to indoor air have no aging effect, whereas high-density polyethylene (HDPE) and fiberglass piping exposed to raw water, soil, and concrete environments are susceptible to cracking, blistering, and changes in color due to water absorption. Because the applicant identified an aging effect that the GALL Report recognizes only for environments considered more severe than indoor air, 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 3.0.3.2.7. 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 the timely detection of parameters indicative of changes in material properties, such as discoloration, surface cracking, crazing, and dimensional changes.

Plastic Piping and Valve Bodies Exposed to Indoor Air. In LRA Table 3.3.2-17-10, the applicant stated that plastic piping and valve bodies exposed to indoor air have no aging effect and proposed no AMP. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and considered whether the applicant identified all credible aging effects for this component, material, and environment description. The GALL Report states that HDPE and fiberglass piping exposed to raw water, soil, and concrete environments are susceptible to cracking, blistering, and changes in color due to water absorption, whereas PVC piping exposed to condensation environments is not cited as having an aging effect. Because the applicant did not provide details on the type of plastic used in the potable water system, it was unclear to the staff whether the applicant identified all the credible aging effects. By letter dated January 14, 2015, the staff issued RAI 3.3.2.3.17.10-1, requesting that the applicant describe the type of plastic used in the potable water system and justify why that plastic is not susceptible to aging.

In its response dated February 12, 2015, the applicant states that the plastic piping and valve bodies in LRA Table 3.3.2-17-10, which cite generic note F, do not perform a safety or license renewal function and are not in the scope of license renewal. The plastic piping and valve bodies, which cite generic note F, have been removed from LRA Table 3.3.2-17-10.

The staff finds the applicant's response to RAI 3.3.2.3.17.10-1 acceptable because the components do not perform a license renewal function and are not in the scope of license renewal. Therefore, the components do not need to be included in LRA Table 3.3.2-17-10 for aging management. The staff's concerns described in RAI 3.3.2.3.17-10-1 are resolved.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-10 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Process Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-11. The staff reviewed LRA Table 3.3.2-17-11, which summarizes the results of AMR evaluations for the process sampling system, nonsafety-related components affecting safety-related systems. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the process sampling system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Post-Accident Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-12. The staff reviewed LRA Table 3.3.2-17-12, which summarizes the results of AMR evaluations for the post-accident sampling system, nonsafety-related components affecting safety-related systems. 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 post-accident sampling system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

General Service Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-13. The staff reviewed LRA Table 3.3.2-17-13, which summarizes the results of AMR evaluations for the general service water system, nonsafety-related components affecting safety-related systems. 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 general service water system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Reactor Building Closed Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-14. The staff reviewed LRA Table 3.3.2-17-14, which summarizes the results of AMR evaluations for the reactor building closed cooling water system, nonsafety-related components affecting safety-related systems. 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 closed cooling water system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Turbine Building Closed Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-15.

Carbon Steel and Stainless Steel Piping, Piping Components, Heat Exchanger Components, and Tanks Exposed to Treated Water, Raw Water, Lubricating Oil, and Fuel Oil. The staff's evaluation for carbon steel and stainless steel piping, piping components, heat exchanger components, and tanks exposed to treated water, raw water, lubricating oil, and fuel oil, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.3.2.3.3.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-15 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Emergency Equipment Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-16.

Carbon Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel Piping Components Exposed to Condensation. The staff's evaluation for stainless steel piping components exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-16 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Emergency Equipment Service Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-17.

Carbon Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel Piping Components Exposed to Condensation. The staff's evaluation for stainless steel piping components exposed to condensation, which will be managed for loss of material by the External Surfaces Monitoring Program and are associated with generic note G, is documented in SER Section 3.2.2.3.8.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-17 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Supplemental Cooling Chilled Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-18. The staff reviewed LRA Table 3.3.2-17-18, which summarizes the results of AMR evaluations for the supplemental cooling chilled water system, nonsafety-related components affecting safety-related systems. 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 supplemental cooling chilled water system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Station Air, Control Air, Emergency Breathing Air System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-19. The staff reviewed LRA Table 3.3.2-17-19, which summarizes the results of AMR evaluations for the station air, control air, emergency breathing air system, nonsafety-related components affecting safety-related systems. 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 station air, control air, emergency breathing air system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Auxiliary Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-20.

Steel Components Exposed to Steam. In LRA Tables 3.3.2-17-20, 3.3.2-17-28, and 3.3.2-17-33, the applicant stated that steel piping, condenser shells, expansion joints, heater housings, humidifiers, strainer housings, traps, and valve bodies exposed to steam (internal) will be managed for loss of material by the Water Chemistry Control – Closed Treated Water Systems Program. The associated 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 the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report Table VIII, which states that steel components exposed to steam can experience loss of material, the staff finds that the aging effects proposed by the applicant effectively describe those essentially identified in the GALL Report; therefore, the staff finds that the applicant has identified all the credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Water Chemistry Control – Closed Treated Water Systems Program is documented in SER Section 3.0.3.2.23. The program includes both inspections and control of water chemistry to mitigate the effects of corrosion. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control – Closed Treated Water System Program acceptable because the inspections are capable of detecting loss of material before loss of intended function, whereas control of water chemistry will mitigate loss of material.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-20 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Waste Oil System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-21. The staff reviewed LRA Table 3.3.2-17-21, which summarizes the results of AMR evaluations for the waste oil system, nonsafety-related components affecting safety-related systems. 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 waste oil system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

On-Line Noble Chemistry Injection System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-22. The staff reviewed LRA Table 3.3.2-17-22, which summarizes the results of AMR evaluations for the online noble chemistry injection system, nonsafety-related components affecting safety-related systems. 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 online noble chemistry injection system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Fire Protection System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-23. The staff reviewed LRA Table 3.3.2-17-23, which summarizes the results of AMR evaluations for the fire protection system, nonsafety-related components affecting safety-related systems. 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 fire protection system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Zinc Injection System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-24. The staff reviewed LRA Table 3.3.2-17-24, which summarizes the results of AMR evaluations for the zinc injection system, nonsafety-related components affecting safety-related systems. 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 zinc injection system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Emergency Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-25. The staff reviewed LRA Table 3.3.2-17-25, which summarizes the results of AMR evaluations for the emergency diesel generator system, nonsafety-related components affecting safety-related systems. 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 diesel generator system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Reactor/Auxiliary Building Systems, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-26. The staff reviewed LRA Table 3.3.2-17-26, which summarizes the results of AMR evaluations for the reactor/auxiliary building systems, nonsafety-related components affecting safety-related systems. 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/auxiliary building systems, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Storage Pools System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-27. The staff reviewed LRA Table 3.3.2-17-27, which summarizes the results of AMR evaluations for the storage pools system, nonsafety-related components affecting safety-related systems. 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 storage pools system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Reactor/Auxiliary Building HVAC System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-28.

Carbon Steel and Stainless Steel Piping, Piping Components, Heat Exchanger Components, and Tanks Exposed to Treated Water, Raw Water, Lubricating Oil, and Fuel Oil. The staff's evaluation for carbon steel and stainless steel piping, piping components, heat exchanger components, and tanks exposed to treated water, raw water, lubricating oil, and fuel oil, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.3.2.3.3.

Carbon Steel Closure Bolting Exposed to Condensation (External). The staff's evaluation for carbon steel closure bolting exposed to condensation (external), which will be managed for loss of preload by the Bolting Integrity Program and is associated with generic note H, is documented in SER Section 3.3.2.3.3.

Stainless Steel Valve Bodies Exposed to Steam. The staff's evaluation for stainless steel valve bodies exposed to steam, which will be managed for cracking and loss of material by the Water Chemistry Control – Closed Treated Water Systems Program and are associated with generic note G, is documented in SER Section 3.3.2.3.17-9.

Steel Components Exposed to Steam. The staff's evaluation for steel piping, condenser shells, expansion joints, heater housings, humidifiers, strainer housings, traps, and valve body components exposed to steam, which will be managed for loss of material by the Water Chemistry Control – Closed Treated Water System Program and are associated with generic note G, is documented in SER Section 3.3.2.3.17-20.

Copper Alloy Coil Components Exposed to Steam. In LRA Tables 3.3.2-17-28 and 3.3.2-17-33, the applicant stated that copper alloy coil components exposed to steam (internal) will be managed for loss of material by the Water Chemistry Control – Closed Treated Water Systems Program. The associated 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 the credible aging effects for this component, material, and environment description. Based on its review of GALL Report Tables VII and VIII, which state that copper alloy components exposed to treated water (internal) can experience loss of material, the staff finds that, under these environmental conditions, the aging effects would be similar to those proposed by the applicant; therefore, the staff finds that the applicant has identified all the credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Water Chemistry Control – Closed Treated Water Systems Program is documented in SER Section 3.0.3.2.23. The program includes both inspections and control of water chemistry to mitigate the effects of corrosion. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control – Closed Treated Water Systems Program acceptable because the inspections are capable of detecting loss of material before loss of intended function, whereas the control of water chemistry will mitigate loss of material.

Stainless Steel Valve Body Exposed to Steam. In LRA Table 3.3.2-17-28, the applicant stated that there is a TLAA for stainless steel valve bodies exposed to steam that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAA for non-Class 1 valve bodies is documented in SER Section 4.3.2.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-28 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Floor and Equipment Drains System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-29. The staff reviewed LRA Table 3.3.2-17-29, which summarizes the results of AMR evaluations for the floor and equipment drains system, nonsafety-related components affecting safety-related systems. 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 floor and equipment drains system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Containment Atmospheric Control System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-30. The staff reviewed LRA Table 3.3.2-17-30, which summarizes the results of AMR evaluations for the containment atmospheric control system, nonsafety-related components affecting safety-related systems. 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 containment atmospheric control system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Primary Containment Pneumatics System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-31. The staff reviewed LRA Table 3.3.2-17-31, which summarizes the results of AMR evaluations for the primary containment pneumatics system, nonsafety-related components affecting safety-related systems. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the primary containment pneumatics system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Primary Containment Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-32. The staff reviewed LRA Table 3.3.2-17-32, which summarizes the results of AMR evaluations for the primary containment monitoring system, nonsafety-related components affecting safety-related systems. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the primary containment monitoring system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Turbine Building HVAC System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-33.

Stainless Steel Valve Bodies Exposed to Steam. The staff's evaluation for stainless steel valve bodies exposed to steam, which will be managed for cracking and loss of material by the Water Chemistry Control – Closed Treated Water Systems Program and are associated with generic note G, is documented in SER Section 3.3.2.3.17-9.

Steel Components Exposed to Steam. The staff's evaluation for steel piping, condenser shells, expansion joints, heater housings, humidifiers, strainer housings, traps, and valve body components exposed to steam, which will be managed for loss of material by the Water Chemistry Control – Closed Treated Water System Program and are associated with generic note G, is documented in SER Section 3.3.2.3.17-20.

Copper Alloy Coils Exposed to Steam. The staff's evaluation for copper alloy coils exposed to steam, which will be managed for loss of material by the Water Chemistry Control – Closed Treated Water Systems Program and are associated with generic note G, is documented in SER Section 3.3.2.3.17-28.

Steel and Stainless Steel Valve Bodies, Piping, Flow Elements, and Thermowells Exposed to Steam and Treated Water. In LRA Table 3.3.2-17-33, the applicant stated that there are TLAAs for steel and stainless steel valve bodies, piping, flow elements, and thermowells exposed to steam and treated water that cite generic note H or G. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.2, for these components, environments, and materials. The staff's evaluation of the fatigue TLAAs for non-Class 1 components is documented in SER Sections 4.3.2.1 and 4.3.2.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.3.2-17-33 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Turbine Building Potable Water and Plumbing System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-34. The staff reviewed LRA Table 3.3.2-17-34, which summarizes the results of AMR evaluations for the turbine building potable water and plumbing system, nonsafety-related components affecting safety-related systems. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the turbine building potable water and plumbing system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

RHR Complex and Office Service Building HVAC Systems, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-35. The staff reviewed LRA Table 3.3.2-17-35, which summarizes the results of AMR evaluations for the RHR complex and office service building HVAC systems, nonsafety-related components affecting safety-related systems. 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 RHR complex and office service building HVAC systems, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

RHR Complex Drains and OSB Potable Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-36. The staff reviewed LRA Table 3.3.2-17-36, which summarizes the results of AMR evaluations for the RHR complex drains and the office service building (OSB) potable water system, nonsafety-related components affecting safety-related systems. 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 RHR complex drains and OSB potable water system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

Beyond Design Basis External Event Mitigation (Fukushima) System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-17-37. The staff reviewed LRA Table 3.3.2-17-37, which summarizes the results of AMR evaluations for the BDBEE mitigation (Fukushima) system, nonsafety-related components affecting safety-related systems. 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 BDBEE mitigation (Fukushima) system, nonsafety-related components affecting safety-related systems, are consistent with the GALL Report.

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion systems components and component groups of the following:

- condensate storage and transfer system
- feedwater and standby feedwater system
- miscellaneous 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 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 systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion 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 ensure the applicant's claim that certain AMRs were consistent with the GALL Report, not applicable, or not used. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The AMRs that the staff confirmed are consistent with the GALL Report are noted as such in SER Table 3.4-1, and no further discussion is required. The AMRs that the staff confirmed are not applicable to Fermi 2 or not used, because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another SER Table 3.1-1 item, or that require no aging management are noted in SER Table 3.4-1 and discussed in SER Section 3.4.2.1.1. 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 of AMRs for which the staff requested additional information are documented in SER Section 3.4.2.1.2.

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 3.4.2.2 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 not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations of AMRs not consistent with, or not addressed in, the GALL Report are documented in SER Section 3.4.2.3.

SER Table 3.4-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.4 and addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion Systems Components in the GALL Report

Component Group (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 SRP Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	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, environ-mental conditions need to be evaluated	External Surfaces Monitoring Program	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, environ-mental conditions need to be evaluated	External Surfaces Monitoring Program	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	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements exposed to steam, treated water (3.4.1-5)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion Program	Consistent with the GALL Report
Steel, stainless steel bolting exposed to soil (3.4.1-6)	Loss of preload	Chapter XI.M18, "Bolting Integrity "	No	Not used. There is no steel or stainless steel bolting exposed to soil in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-7)	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Not used. There is no high strength steel bolting in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
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 Program	Consistent with the GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.4.1-9)	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not used. As stated in item 3.4.1-8, loss of material of steel bolting exposed to air in the steam and power conversion systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment.	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 Program	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 – BWR and One-Time Inspection programs	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 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 – BWR and One-Time Inspection programs	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to treated water (3.4.1-13)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements, PWR heat exchanger components exposed to steam, treated water (3.4.1-14)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	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	Water Chemistry Control – BWR and One-Time Inspection programs	Consistent with the GALL Report
Copper alloy, stainless steel, nickel alloy, aluminum piping, piping components, and piping elements, heat exchanger components and tubes, PWR heat exchanger components exposed to treated water, steam (3.4.1-16)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	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	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Copper alloy, stainless steel heat exchanger tubes exposed to treated water (3.4.1-18)	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Water Chemistry Control – BWR and One-Time Inspection programs	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 used. There are no heat exchanger components exposed to raw water in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy, 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 used. There are no piping components exposed to raw water (open cycle cooling water) in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
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	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Stainless steel, copper alloy, steel heat exchanger tubes, heat exchanger components exposed to raw water (3.4.1-22)	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not used. There are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F) (3.4.1-23)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not used. There are no stainless steel components exposed to closed-cycle cooling water > 60 °C (> 140 °F) in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Steel heat exchanger components exposed to closed-cycle cooling water (3.4.1-24)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not used. There are no steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel 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 used. There are no steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water (3.4.1-26)	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not used. There are no stainless steel components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Copper-alloy piping, piping components, and piping elements exposed to closed-cycle cooling water (3.4.1-27)	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not used. There are no copper alloy components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
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 used. There are no heat exchanger tubes exposed to closed-cycle cooling water with an intended function of heat transfer in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Steel tanks exposed to air – outdoor (external) (3.4.1-29)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not used. There are no steel tanks exposed to outdoor air in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, 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, pitting, and crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not used. There are no steel or stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, “Aboveground Metallic Tanks”) in the steam and power conversion systems. Aluminum tanks are addressed in item 3.4.1-31.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Stainless steel, aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.4.1-31)	Loss of material due to pitting, and crevice corrosion; cracking due to stress corrosion cracking	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Aboveground Metallic Tanks Program	Consistent with the GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil (3.4.1-32)	Loss of material due to selective leaching	Chapter XI.M33, “Selective Leaching”	No	Not used. There are no gray cast iron components exposed to soil in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
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 Program	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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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	Buried and Underground Piping Program	Consistent with the GALL Report (see SER Section 3.4.2.1.2)
Steel piping, piping components, and piping elements exposed to air – outdoor (internal) (3.4.1-36)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements exposed to condensation (internal) (3.4.1-37)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)
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	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to condensation (internal) (3.4.1-39)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not used. There are no stainless steel components exposed to condensation in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
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 programs	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	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Aluminum piping, piping components, and piping elements exposed to lubricating oil (3.4.1-42)	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper-alloy piping, piping components, and piping elements exposed to 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	Oil Analysis and One-Time Inspection programs	Consistent with the GALL Report
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 programs	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	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Stainless steel, steel, copper alloy heat exchanger tubes exposed to lubricating oil (3.4.1-46)	Reduction of heat transfer due to fouling	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)
Steel (with coating or wrapping) stainless steel, nickel alloy piping, piping components, and piping elements; tanks exposed to soil or concrete (3.4.1-47)	Loss of material due to general (steel only), pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping Program	Consistent with the GALL Report
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 used. There is no stainless steel or nickel alloy bolting exposed to soil in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete (3.4.1-49)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel 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 used. There is no steel bolting exposed to soil in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Underground stainless steel, nickel alloy, and 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 used. There is no underground piping in areas of restricted access in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements exposed to concrete (3.4.1-51)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not used. There are no steel components embedded in concrete in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Aluminum piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (internal/external) (3.4.1-52)	None	None	NA - No AEM or AMP	None Consistent with NUREG-1801, “Generic Aging Lessons Learned (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 (3.4.1-53)	None	None	NA - No AEM or AMP	Not applicable	Not applicable to BWRs (see SER Section 3.4.2.1.1)
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	None	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
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	None	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	None	Consistent with the GALL Report
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 used. There are no nickel alloy or PVC components exposed to the environments represented by this item in the steam and power conversion systems in the scope of license renewal.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), concrete, gas, air – indoor, uncontrolled (internal) (3.4.1-58)	None	None	NA - No AEM or AMP	None	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 used. There are no steel steam and power conversion system components exposed to the environments represented by this item in the scope of license renewal.	Not used (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Any material, piping, piping components, and piping elements exposed to treated water (3.4.1-60)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion Program	Consistent with the GALL Report
Metallic piping, piping components, and tanks exposed to raw water or wastewater (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 used. No conditions of recurring internal corrosion (RIC) as defined in LR-ISG-2012-02, Section A, were identified in piping components of the steam and power conversion systems.	Not applicable to Fermi 2 (see SER Section 3.4.2.2.6)
Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water (3.4.1-62)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Aboveground Metallic Tanks Program	Consistent with the GALL Report
Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor (3.4.1-63)	Loss of material due to general (steel, and copper alloy), pitting, or crevice corrosion, and cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only)	No	External Surfaces Monitoring and Aboveground Metallic Tanks programs	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	Not used. There are no insulation components with an intended function of thermal insulation in the steam and power conversion systems.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)
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 used. There are no insulation components with an intended function of thermal insulation in the steam and power conversion systems.	Not applicable to Fermi 2 (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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, 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 to spalling for cementitious coatings/linings	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Coating Integrity Program	Consistent with the GALL Report (see SER Section 3.4.2.3.3)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.4.1-67)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not used	Not used (see SER Section 3.4.2.1.1)
Gray cast iron piping components with internal coatings/linings exposed to closed cycle cooling water, raw water, or treated water (3.4.1-68)	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not used	Not used (see SER Section 3.4.2.1.1)

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion systems components:

- Aboveground Metallic Tanks
- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR

LRA Tables 3.4.2-1 through 3.4.2-3-9 summarize AMRs for the steam and power conversion 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 of 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 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 reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the

LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.4.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.4.1, items 3.4.1-4, 3.4.1-13, 3.4.1-17, 3.4.1-21, 3.4.1-36, 3.4.1-37, 3.4.1-38, 3.4.1-41, 3.4.1-42, 3.4.1-45, 3.4.1-46, and 3.4.1-53, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed these items only apply to PWRs; and finds that these items are not applicable to Fermi 2, which is a BWR.

For LRA Table 3.4.1, items 3.4.1-6, 3.4.1-7, 3.4.1-9, 3.4.1-19, 3.4.1-20, 3.4.1-22, 3.4.1-23, 3.4.1-24, 3.4.1-25, 3.4.1-26, 3.4.1-27, 3.4.1-28, 3.4.1-29, 3.4.1-30, 3.4.1-32, 3.4.1-39, 3.4.1-51, 3.4.1-57, 3.4.1-59, 3.4.1-64, and 3.4.1-65, the applicant claimed that the corresponding items in the GALL Report are not applicable or are not used because the component, material and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another Table 1 line item. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items or that the aging effects addressed by other Table 1 AMR line items are appropriate.

For LRA Table 3.4.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable or are not used. However, the staff had to review sources beyond the LRA and UFSAR or to issue one or more RAIs, or both, in order to verify the applicant's claim of nonapplicability or not used.

LRA Table 3.4.1, item 3.4.1-48, addresses stainless steel and nickel alloy bolting exposed to soil. The GALL Report recommends GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," to manage loss of material due to pitting and crevice corrosion for this component group. The applicant stated that this line item was not used because there is no stainless steel or nickel alloy bolting exposed to soil in the steam and power conversion systems. The staff evaluated the applicant's claim and finds it acceptable based on its review of plant-specific drawings during the AMP audit.

LRA Table 3.4.1, item 3.4.1-50, addresses steel bolting exposed to soil. The GALL Report recommends GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item was not used because there is no steel bolting exposed to soil in the steam and power conversion systems. The staff evaluated the applicant's claim and finds it acceptable based on its review of plant-specific drawings during the AMP audit.

LRA Table 3.4.1, item 3.4.1-50.5, addresses underground stainless steel; nickel alloy; and steel piping, piping components, and piping elements. The GALL Report recommends GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," to manage loss of material for this component group. The applicant stated that this item is not used because there is no underground piping in areas of restricted access in the steam and power conversion systems. GALL Report AMP XI.M41 states that underground piping is below grade but contained within a tunnel or vault such that it is in contact with air and is located where access for inspection is restricted. The staff evaluated the applicant's claim and finds it acceptable because, during the AMP audit, the staff observed the CST dog house pit and confirmed that access to the below-grade piping in the steam and conversion system is available through an entranceway that can be opened unassisted (i.e., not restricted) by plant staff.

SER Table 3.4-1, items 3.4.1-67 and 3.41-68, reflect changes to the SRP-LR incorporated by LR-ISG-2013-01, “Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.” The ISG added these line items to allow applicants to credit the new GALL Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; or selective leaching in certain components. The applicant did not credit the related plant-specific AMP, “Coating Integrity,” for the aging effect and components that reference SRP-LR items 3.4.1-67 and 3.4.1-68 but instead credited alternate items and programs to manage the effects of these aging mechanisms for these components. For example, in regard to item 3.4.1-67, loss of material for an internally coated tank in the condensate system exposed to treated water is managed by the Water Chemistry – BWR Program. In regard to item 3.3.1-68, there are no gray cast iron components in the steam and power conversion systems. The staff finds this approach acceptable because the alternate items and programs used are adequate to manage the effects of aging for these components and because this approach is consistent with GALL Report AMP XI.M42.

3.4.2.1.2 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.4.1, item 3.4.1-35, addresses aluminum piping exposed to outdoor air, 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 Buried and Underground Piping Program to manage the aging effect for aluminum piping in the condensate storage and transfer system. The GALL Report recommends GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” to ensure that this aging effect is adequately managed. GALL Report AMP XI.M36 recommends using periodic visual inspections to manage the effects of aging.

The staff’s evaluation of the applicant’s Buried and Underground Piping Program is documented in SER Section 3.0.3.1.2. The staff noted that GALL Report AMP XI.M36 recommends the use of GALL Report AMP XI.M41, “Buried and Underground Piping and Tanks,” for piping that is located in a tunnel or vault such that access for inspections is restricted. The applicant’s Buried and Underground Piping Program includes inspections that are consistent with those recommended in GALL Report AMP XI.M41. Specifically, at least 1 percent of the length of underground aluminum piping (not to exceed one inspection of a 10-foot length) is visually inspected in each 10-year period to detect external corrosion. Based on its review of components associated with item 3.4.1-35 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the Buried and Underground Piping Program acceptable because the applicant is managing underground aluminum components in a manner consistent with GALL Report guidance.

The staff concludes that, for LRA item 3.4.1-35, 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).

3.4.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation Is Recommended

In LRA Section 3.4.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the steam and power conversion systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- QA for aging management of nonsafety-related components
- ongoing review of operating experience
- loss of material due to recurring internal corrosion

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.4.2.2. The staff's review of the applicant's further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

LRA Section 3.4.2.2.1 is associated with LRA Table 3.4.1, item 3.4.1-1, that addresses steel piping, piping components, and piping elements exposed to steam or treated water, which will be managed for cumulative fatigue damage. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, and is evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.4.2.2.1 against the criteria in SRP-LR Section 3.4.2.2.1, which state that cumulative fatigue damage of steel piping, piping components, and piping elements is a TLAA and must be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed the applicant's AMR line items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage in steel and stainless steel piping, piping components, and piping elements.

Based on its review, the staff concludes that the applicant has met the SRP-LR Section 3.4.2.2.1 criteria. For those line items that apply to LRA Section 3.4.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3 documents the staff's review of the applicant's evaluation of the TLAA for these components.

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 that 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 state 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 will be managed by the External Surfaces Monitoring Program. The applicant also stated that there are no indoor stainless steel steam and power conversion system components located near outdoor air intakes that could also be subject to this aging effect.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The staff noted that the subject components at the applicant's site carry water and are associated with the condensate storage and transfer system. The staff also noted that the applicant's program includes periodic visual inspections of external surfaces, which are 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 that its 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 before 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 that 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 will be managed by the External Surfaces Monitoring Program. The applicant also stated that there are no indoor stainless steel steam and power conversion system components located near outdoor air intakes that could also be subject to this aging effect.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.7. The staff noted that the applicant's program includes periodic visual inspections of external surfaces, which are 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 that its 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 before 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 for 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 wastewater. 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 an operating experience search for repeated instances in which an aging effect resulted in a component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent. The applicant stated that this item is not applicable because a review of plant operating experience identified no conditions of recurring internal corrosion in the steam and power conversion systems. 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 meet 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 3.4.2-3-9, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-3-9, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable.

Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations that were 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 Storage and Transfer System – Summary of Aging Management Review – LRA Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the condensate storage and transfer system component groups.

Piping and Piping Components Exposed to Outdoor Air and Soil. In LRA Tables 3.4.2-1 and 3.4.2-2, the applicant stated that aluminum, carbon steel, and stainless steel flex connections, piping, and valve bodies exposed to outdoor air and soil will be managed for loss of material and cracking (aluminum and stainless steel only) by the Buried and Underground Piping Program. The AMR items cite generic notes G and H.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. The GALL Report provides the following aging effects for the material and environment combinations cited in these tables:

- Item SP-147 states that aluminum components exposed to outdoor air are susceptible to loss of material.
- Item S-41 states that carbon steel components exposed to outdoor air are susceptible to loss of material.
- Item SP-94 states that stainless steel components exposed to soil are susceptible to loss of material.
- Item SP-118 states that stainless steel components exposed to outdoor air are susceptible to cracking.

In addition, Table 8.2, "Environment – Alloy Combinations Known to Produce Stress-Corrosion Cracking," in the report entitled, "Principles and Prevention of Corrosion," D.A. Jones, second edition, states that aluminum alloys are susceptible to SCC in the presence of air with water vapor.

Based on its review of the above reference, 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 Buried and Underground Piping Program is documented in SER Section 3.0.3.1.2. The staff finds the applicant's proposal to manage the effects of aging using the Buried and Underground Piping Program acceptable because it includes periodic visual inspections that are capable of detecting loss of material and cracking.

On the basis of its review, the staff concludes that for items in LRA Tables 3.4.2-1 and 3.4.2-2 with an AERM, the applicant has demonstrated that the effects of aging for these items will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Stainless Steel Flex Connections Exposed to Outdoor Air. In LRA Table 3.4.2-1, the applicant stated that there is a TLAA for stainless steel flex connections exposed to outdoor air that cites generic note G. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component, environment, and material. The staff's evaluation of the fatigue TLAA for non-Class 1 components, other than piping, is documented in SER Section 4.3.2.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-1 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Feedwater and Standby Feedwater System – Summary of Aging Management Review – LRA Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the feedwater and standby feedwater system component groups.

Piping and Piping Components Exposed to Outdoor Air. The staff's evaluation for carbon steel and stainless steel piping and piping components exposed to outdoor air, which will be managed for loss of material and cracking by the Buried and Underground Piping Program and are associated with generic note G, is documented in SER Section 3.4.2.3.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-2 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Evaluation – LRA Tables 3.4.2-3-1 through 3.4.2-3-9

The staff reviewed LRA Tables 3.4.2-3-1 through 3.4.2-3-9, which summarize the results of AMR evaluations for the system name component groups.

Main Steam System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-1.

Stainless Steel Thermowell Exposed to Steam. In LRA Table 3.4.2-3-1, the applicant stated that there is a TLAA for stainless steel thermowells exposed to steam that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAA for non-Class 1 components, other than piping, is documented in SER Section 4.3.2.2.

Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-2.

Carbon Steel Heat Exchanger Components and Tanks Exposed to Treated Water and Raw Water. As amended by letter dated February 15, 2015, LRA Tables 3.4.2-3-2, 3.4.2-3-5, and

3.4.2-3-6 state that carbon steel heat exchanger components and tanks exposed to treated water and raw water will be managed for loss of coating integrity by the Coating Integrity Program. The AMR items cite generic note H.

The staff noted that although the applicant cited generic note H, 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,” provides AMR line items to address this MEAP combination. SRP-LR Table 3.4-1, item 3.4.1-66, states that metallic heat exchangers and tanks with internal coatings/linings exposed to raw water and treated water are managed for loss of coating integrity by GALL Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.”

The staff’s evaluation of the applicant’s Coating Integrity Program is documented in SER Section 3.0.3.2.24. The staff finds the applicant’s proposal to manage the effects of aging using the Coating Integrity Program acceptable because periodic visual inspections of internal coatings by qualified personnel are capable of detecting loss of coating integrity.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-3-2 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Feedwater and Standby Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-3</u>.

Stainless Steel Flow Element Exposed to Steam. In LRA Table 3.4.2-3-3, the applicant stated that there is a TLAA for stainless steel flow elements exposed to steam that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff’s evaluation of the fatigue TLAA for non-Class 1 piping elements is documented in SER Section 4.3.2.1.

<u>Heater Drains System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-4</u>.

Carbon Steel with Nickel Alloy Clad Valve Body Exposed to Treated Water (Internal). As amended by letter dated June 26, 2015, in LRA Table 3.4.2-3-4, the applicant stated that carbon steel with nickel alloy clad valve body exposed internally to treated water will be managed for loss of material by the Water Chemistry Control – BWR Program. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed cracking due to fatigue for these component, material, and environment combinations in other AMR items in LRA Tables 3.4.2-3-4, 3.4.2-3-5, and 3.4.2-3-9 and loss of material due to flow-accelerated corrosion in piping in an AMR item in LRA Table 3.4.2-3-9. The staff noted that EPRI TR-1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4,” dated January 2006, states that cracking due to SCC or intergranular attack is an aging effect of concern for nickel alloys in the power production loop (i.e., condensate, feedwater, and main steam systems), or if temperature is greater than 500 °F and the oxygen concentration is greater than 100 ppb or chlorides are greater than 150 ppb. Loss of material is also an aging effect of concern if the oxygen concentration and chlorides are above these limits. The staff noted that that the GALL Report identifies cracking and loss of material as applicable aging effects for nickel alloy components exposed to treated water. Based on its review of the EPRI TR-1010639 and the GALL Report, which state that nickel alloys can be subject to the aging effects of cracking and loss of material, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's One-Time Inspection and Water Chemistry Control – BWR programs are documented in SER Sections 3.0.3.1.17 and 3.0.3.1.20, respectively. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control - BWR Program and One-Time Inspection Program acceptable because the water chemistry controls limit oxygen concentration and contaminants, such as chlorides, to minimize cracking and loss of material and because a one-time inspection of a representative sample of components will verify the effectiveness of the water chemistry controls.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-3-4 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Main Turbine Generator and Auxiliaries System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-5.

Carbon Steel Heat Exchanger Components and Tanks Exposed to Treated Water and Raw Water. The staff's evaluation for carbon steel heat exchanger components and tanks exposed to treated water and raw water, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.4.2.3.3-2.

Elastomer Flex Connections Exposed to Steam. The staff's evaluation for elastomer flex connections exposed to steam, which will be managed for cracking and changes in material properties by the Internal Surfaces in Miscellaneous Piping and Ducting Component Program and are associated with generic note G, is documented in SER Section 3.3.2.3.3.

Aluminum Traps Exposed to Wastewater. In LRA Table 3.4.2-3-5, the applicant stated that aluminum traps exposed internally to wastewater 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 the credible aging effects for this component, material, and environment description. The GALL Report states that aluminum components exposed to raw water (i.e., untreated surface water or groundwater) and potential contaminants, such as lubricating oil and fuel oil, are susceptible only to loss of material. The ASM International's *Metals Handbook*, Desk Edition, states that SCC is most likely in the highest strength grades of structural aluminum, such as those used in armor plate and automotive structural components. 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 3.0.3.1.11. 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 before loss of the intended function.

Stainless Steel and Nickel Piping, Valve Bodies, Expansion Joints, Flow Element, Orifices, and Thermowells Exposed to Steam. In LRA Table 3.4.2-3-5, the applicant stated that there are TLAAs for stainless steel and nickel piping, valve bodies, expansion joints, flow element, orifices, and thermowells exposed to steam that cite generic note H or G. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.2, for these components, environment, and materials. The staff's evaluation of the fatigue TLAAs for non-Class 1 components is documented in SER Sections 4.3.2.1 and 4.3.2.2.

Nickel Alloy Expansion Joints and Piping Exposed to Steam. In LRA Tables 3.4.2-3-5 and 3.4.2-3-9, the applicant stated that nickel alloy expansion joints and piping exposed internally to steam will be managed for cracking and loss of material by the Water Chemistry Control – BWR Program. The AMR items cite generic note G. As stated in LRA Table 3.0-1, steam is subject to a water chemistry program, and for determining aging effects, steam is considered as treated water. As documented in LRA Sections B.1.33 and B.1.43, the One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Control – BWR 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 the applicant addressed cracking due to fatigue for these components, material, and environment combinations in other AMR items in LRA Tables 3.4.2-3-5 and 3.4.2-3-9 and loss of material due to flow-accelerated corrosion in piping in an AMR item in LRA Table 3.4.2-3-9. The staff notes that EPRI TR-1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4," dated January 2006, states that cracking due to stress corrosion cracking or intergranular attack is an aging effect of concern for nickel alloys in the power production loop (i.e., condensate, feedwater, and main steam systems), or if the temperature is greater than 500 °F and if the oxygen concentration is greater than 100 ppb or if chlorides are greater than 150 ppb. Loss of material is also an aging effect of concern if the oxygen concentration and chlorides are above these limits. Therefore, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's One-Time Inspection and Water Chemistry Control – BWR programs are documented in SER Sections 3.0.3.1.17 and 3.0.3.1.20, respectively. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control – BWR Program and One-Time Inspection Program acceptable because the water chemistry controls limit oxygen concentration and contaminants, such as chlorides, to minimize cracking and loss of material and because a one-time inspection of a representative sample of components will verify the effectiveness of the water chemistry controls.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-3-5 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Condenser and Auxiliaries System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-6.

Carbon Steel Heat Exchanger Components and Tanks Exposed to Treated Water and Raw Water. The staff's evaluation for carbon steel heat exchanger components and tanks exposed to treated water and raw water, which will be managed for loss of coating integrity by the Coating Integrity Program and are associated with generic note H, is documented in SER Section 3.4.2.3.3-2.

Stainless Steel Expansion Joints Exposed to Steam. In LRA Table 3.4.2-3-6, the applicant stated that there is a TLAA for stainless steel expansion joints exposed to steam that cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.2, for this component and material. The staff's evaluation of the fatigue TLAA for non-Class 1 components, other than piping, is documented in SER Section 4.3.2.2.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-3-6 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-7.

Plastic Piping Exposed to Indoor Air. The staff's evaluation for plastic piping exposed to indoor air, which will be managed for change in material properties by the External Surfaces Monitoring Program and is associated with generic note F, is documented in SER Section 3.3.2.3.17.

Plastic Piping Exposed to Raw Water. In LRA Table 3.4.2-3-7, the applicant stated that for plastic piping internally exposed to raw water, there is no aging effect and no proposed AMP. The AMR item cites generic note F.

During the audit, the staff reviewed plant-specific drawings and identified that the plastic piping exposed to raw water in LRA Table 3.4.2.3-7 is constructed of PVC. 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 the American Water Works Association manual, *PVC Pipe – Design and Installation – Manual of Water Supply Practices, M23*, Second Edition, dated 2002, states, "PVC and PVCO pipes are resistant to almost all types of corrosion – both chemical and electrochemical – that are experienced in underground piping systems. Because PVC is a nonconductor, galvanic and electrochemical effects are nonexistent in PVC piping systems. PVC pipe cannot be damaged by aggressive waters or corrosive soils." It also states, "PVC pipe is nearly totally resistant to biological attack. Biological attack can be described as degradation or deterioration caused by the action of living microorganisms or macroorganisms." It further states, "PVC pipe is well suited to applications where abrasive conditions are anticipated." Appendix A, "Chemical Resistance Tables," to this manual lists PVC as generally resistant to chemicals up to 140 °F, such as bleach (12.5 percent active chlorine), potassium hydroxide, sodium hydroxide, kerosene, hydrochloric acid, hydrogen peroxide (90 percent), sea water, soaps, and sulfuric acid (70 percent). The staff also noted that *PVC Formulary*, G. Wypych, ChemTec Publishing, dated September 28, 2009, states that "[a]s a general rule, PVC is not resistant to polar solvents but very resistant to acids, bases, salts, alcohols, esters, and hydrocarbons." Given that the PVC piping is located in the circulating water system, it is not clear to the staff whether chlorine is injected into the system and at what levels. By letter dated December 17, 2014, the staff issued RAI 3.4.2.3.3-7-1, requesting that the applicant state whether chlorine is injected into the circulating water system. If chlorine is injected, the applicant should state the percent of active chlorine that would be present in the PVC piping. If the free chlorine exceeds 12.5 percent, the applicant should explain how aging of the PVC pipe will be managed.

In its response dated January 15, 2015, the applicant stated that the in-scope portions of the system constructed of PVC and exposed to raw water are in the normally isolated circulating water drain down system. The chlorine levels in this portion of the system are significantly less than 12.5 percent.

The staff noted that the circulating water drain down system would not be expected to be exposed to temperatures as high as 140 °F. The staff finds the applicant's response and proposal that there are no AERMs acceptable based on its review of the above references, which state that PVC piping exposed to low-temperature water (less than 140 °F) and low chlorine levels is not subject to degradation. The staff's concern described in RAI 3.4.2.3.3-7-1 is resolved.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-3-7 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also concludes that for items in this table with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Condenser Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-8</u>. The staff reviewed LRA Table 3.4.2-3-8, which summarizes the results of AMR evaluations for the condenser storage and transfer system, nonsafety-related components affecting safety-related systems. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the condenser storage and transfer system, nonsafety-related components affecting safety-related systems are consistent with the GALL Report.

<u>Drips, Drains and Vents System, Nonsafety-Related Components Affecting Safety-Related Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-3-9</u>.

<u>*Nickel and Stainless Steel Expansion Joints, Piping, Tubing, Valve Bodies, and Orifices Exposed to Steam*</u>. In LRA Table 3.4.2-3-9, the applicant stated that there are TLAAs for nickel and stainless steel expansion joints, piping, tubing, valve bodies, and orifices exposed to steam that cite generic note H or G. The staff confirmed that there are TLAAs, as documented in LRA Section 4.3.2, for these components and materials. The staff's evaluation of the fatigue TLAAs for non-Class 1 components is documented in SER Sections 4.3.2.1 and 4.3.2.2.

<u>*Nickel Alloy Expansion Joints and Piping Exposed to Steam*</u>. In LRA Tables 3.4.2-3-5 and 3.4.2-3-9, the applicant stated that nickel alloy expansion joints and piping exposed internally to steam will be managed for cracking and loss of material by the Water Chemistry Control – BWR Program. The AMR items cite generic note G. As stated in LRA Table 3.0-1, steam is subject to a water chemistry program, and for determining aging effects, steam is considered as treated water. As documented in LRA Sections B.1.33 and B.1.43, the One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Control – BWR 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 the applicant addressed cracking due to fatigue for these components, material, and environment combinations in other AMR items in LRA Tables 3.4.2-3-5 and 3.4.2-3-9 and loss of material due to flow-accelerated corrosion in piping in an AMR item in LRA Table 3.4.2-3-9. The staff notes that EPRI TR-1010639 "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4," dated January 2006, states that cracking due to stress corrosion cracking or intergranular attack is an aging effect of concern for nickel alloys in the power production loop (i.e., condensate, feedwater, and main steam systems), or if temperature is greater than 500 °F and if the oxygen concentration is greater than 100 ppb or if chlorides are greater than 150 ppb. Loss of material is also an aging effect of concern if the oxygen concentration and chlorides are above these limits. Therefore, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's One-Time Inspection and Water Chemistry Control – BWR programs are documented in SER Sections 3.0.3.1.17 and 3.0.3.1.20, respectively. The staff finds the applicant's proposal to manage aging using the Water Chemistry Control – BWR Program and One-Time Inspection Program acceptable because the water chemistry controls limit oxygen concentration and contaminants, such as chlorides, to minimize cracking and loss of material and because a one-time inspection of a representative sample of components will verify the effectiveness of the water chemistry controls.

On the basis of its review, the staff concludes that for items in LRA Table 3.4.2-3-9 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effect of aging for the steam and power conversion systems 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).

3.5 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 component groups of the following:

- reactor/auxiliary building and primary containment
- water-control structures
- turbine building, process facilities, and yard 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 1–9 Structures, are generically defined in GALL Report Chapter III.A, "Safety Related and Other Structures."

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 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 condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5, as amended by letter dated May 9, 2016, 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 ensure the applicant's claim that certain AMRs are consistent with the GALL Report, not applicable, or not used. 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. The AMRs that the staff confirmed are consistent with the GALL Report are noted as such in SER Table 3.5-1 and no further discussion is required. The AMRs that the staff confirmed are not applicable to Fermi 2 or not used, because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another SER Table 3.1-1 item, or that require no aging management are noted in SER Table 3.5-1 and are discussed in SER Section 3.5.2.1.1. Details of the staff's evaluation of the AMRs that the applicant claimed are consistent with the GALL Report, but for which a different AMP from the program recommended in the GALL Report is used to manage aging, and AMRs for which the staff requested additional information are documented in SER Sections 3.5.2.1.2 through 3.5.2.1.9.

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 3.5.2.2 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 not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations of AMRs not consistent with, or not addressed in, the GALL Report are documented in SER Section 3.5.2.3.

SER 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
BWR Concrete and Steel (Mark I, II, and III) Containments					
Concrete: dome; wall; basemat; ring girders; buttresses, concrete elements, all (3.5.1-1)	Cracking and distortion due to increased stress levels from settlement	Chapter XI.S2, "ASME Section XI, Subsection IWL" or Chapter XI.S6, "Structure Monitoring" If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Concrete: foundation; subfoundation (3.5.1-2)	Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation	Chapter XI.S6, "Structures Monitoring" If a de-watering system is relied upon for control of erosion, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Concrete: dome; wall; basemat; ring girders; buttresses; Concrete: containment; wall; basemat; Concrete: basemat, concrete fill-in annulus (3.5.1-3)	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Steel elements (inaccessible areas): drywell shell; drywell head; and drywell shell (3.5.1-4)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is indicated from the IWE examina-tions	Containment Inservice Inspection – IWE and Containment Leak Rate programs	Consistent with the GALL Report (see SER Section 3.5.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements (inaccessible areas): liner; liner anchors; integral attachments; Steel elements (inaccessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable) (3.5.1-5)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is indicated from the IWE examina-tions	Not used. The torus shell steel elements are accessible and are addressed in item 3.5.1-6. The loss of material for inaccessible areas of steel drywell shell; drywell head; and drywell shell in sand pocket regions is addressed in item 3.5.1-4 (as applicable). Steel elements (inaccessible areas): liner, liner anchors, and integral attachments, are applicable to PWR containments.	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Steel elements: torus shell (3.5.1-6)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is significant, recoating of the torus is recom-mended.	Containment Inservice Inspection and Containment Leak Rate programs	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Steel elements: torus ring girders; downcomers; Steel elements: suppression chamber shell (interior surface) (3.5.1-7)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE"	Yes, if corrosion is significant	Containment Inservice Inspection – IWE Program	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Pre-stressing system: tendons (3.5.1-8)	Loss of prestress due to relaxation; shrinkage; creep; elevated temperature	Yes, TLAA	Yes, TLAA	Not applicable	Not applicable to Fermi 2 (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)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Penetration sleeves; penetration bellows (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 programs	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	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): containment; wall; basemat, Concrete (inaccessible areas): basemat, concrete fill-in annulus (3.5.1-12)	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated function	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat (3.5.1-13)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): containment; wall; basemat (3.5.1-14)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.1)
Concrete (accessible areas): basemat (3.5.1-15)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete (accessible areas): basemat, Concrete: containment; wall; basemat (3.5.1-16)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, “ASME Section XI, Subsection IWL,” or Chapter XI.S6, “Structures Monitoring”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses (3.5.1-17)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat (3.5.1-18)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat, Concrete (accessible areas): containment; wall; basemat, Concrete (accessible areas): basemat, concrete fill-in annulus (3.5.1-19)	Cracking due to expansion from reaction with aggregates	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
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	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
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	Not applicable to Fermi 2 (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): 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	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Concrete (inaccessible areas): basemat; reinforcing steel, Concrete (inaccessible areas): dome; wall; basemat; reinforcing steel (3.5.1-23)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (accessible areas): dome; wall; basemat (3.5.1-24)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"	No	Not applicable	Not applicable to Fermi 2 (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	Not applicable to BWRs (see SER Section 3.5.2.1.1)
Moisture barriers (caulking, flashing, and other sealants) (3.5.1-26)	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	Containment Inservice Inspection – IWE and Periodic Surveillance and Preventive Maintenance programs	Consistent with GALL Report (see SER Section 3.5.2.1.2)
Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell (3.5.1-27)	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Not applicable	Not applicable to Fermi 2 (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 programs	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
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 programs	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 programs	Consistent with the GALL Report
Pressure-retaining bolting, Steel elements: downcomer pipes (3.5.1-31)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	Containment Inservice Inspection – IWE Program	Consistent with the GALL Report
Prestressing system: tendons; anchorage components (3.5.1-32)	Loss of material due to corrosion	Chapter XI.S2, "ASME Section XI, Subsection IWL"	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
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 Program	Consistent with the GALL Report
Service Level I coatings (3.5.1-34)	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No	Protective Coating Monitoring and Maintenance Program	Consistent with the GALL Report
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 – IWE and Containment Leak programs	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements: 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	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
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	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Steel elements: suppression chamber shell (interior surface) (3.5.1-38)	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Steel elements: vent line bellows (3.5.1-39)	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Containment Inservice Inspection Program and Containment Leak Rate programs	Consistent with the GALL Report
Unbraced downcomers, Steel elements: vent header; downcomers (3.5.1-40)	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt (3.5.1-41)	None	None	NA - No AEM or AMP	None	Consistent with the GALL Report
Safety-Related and Other Structures; and Component Supports					
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, for plants located in moderate to severe weathering conditions	Structures Monitoring Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
All Groups except Group 6: concrete (inaccessible areas): all (3.5.1-43)	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated	Structures Monitoring Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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, if a de-watering system is relied upon to control settlement	Structures Monitoring Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 1-3, 5-9: concrete: foundation; subfoundation (3.5.1-45)	Reduction in foundation strength, cracking due to differential settlement, erosion of porous concrete subfoundation	Chapter XI.S6, “Structures Monitoring” If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Not applicable	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
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, if a de-watering system is relied upon to control settlement	Not applicable	Consistent with the GALL Report (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, if leaching is observed in accessible areas that impact intended function	Structures Monitoring Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 1-5: concrete: all (3.5.1-48)	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.2.)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 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, for plants located in moderate to severe weathering conditions	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 6: concrete (inaccessible areas): all (3.5.1-50)	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab (3.5.1-51)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
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, plant specific	Structures Monitoring Program	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-53)	Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	Yes, TLAA	Yes, TLAA	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.2.2)
All groups except 6: concrete (accessible areas): all (3.5.1-54)	Cracking due to expansion from reaction with aggregates	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring Program	Consistent with the GALL Report
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates (3.5.1-55)	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete: exterior above- and below-grade; foundation; interior slab (3.5.1-56)	Loss of material due to abrasion; cavitation	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report
Constant and variable load spring hangers; guides; stops (3.5.1-57)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Inservice Inspection – IWF (ISI-IWF) Program	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	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report
Group 6: concrete (accessible areas): all (3.5.1-59)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: concrete (accessible areas): exterior above- and below-grade; foundation (3.5.1-60)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report
Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab (3.5.1-61)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report
Group 6: wooden piles; sheeting (3.5.1-62)	Loss of material; change in material properties due to weathering, chemical degradation, and insect infestation repeated wetting and drying, fungal decay	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation (3.5.1-63)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S6, "Structures Monitoring"	No	Structures Monitoring Program	Consistent with the GALL Report (see SER Section 3.5.2.1.3)
Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation (3.5.1-64)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S6, "Structures Monitoring"	No	Structures Monitoring Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 Program	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 Program	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 Program	Consistent with the GALL Report
High-strength structural bolting (3.5.1-68)	Cracking due to stress corrosion cracking	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
High-strength structural bolting (3.5.1-69)	Cracking due to stress corrosion cracking	Chapter XI.S6, “Structures Monitoring” Note: ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not shown to be prone to SCC. SCC potential need not be evaluated for these bolts.	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Masonry walls: all (3.5.1-70)	Cracking due to restraint shrinkage, creep, and aggressive environment	Chapter XI.S5, “Masonry Walls”	No	Masonry Wall Program	Consistent with the GALL Report
Masonry walls: all (3.5.1-71)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S5, “Masonry Walls”	No	Masonry Wall Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 and Periodic Surveillance and Preventive Maintenance programs	Consistent with the GALL Report (see SER Section 3.5.2.1.2)
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 Program	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	Not applicable to Fermi 2 (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 applicable	Not applicable to Fermi 2 (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	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Steel components: all structural steel (3.5.1-77)	Loss of material due to corrosion	Chapter XI.S6, "Structures Monitoring" If protective coatings are relied upon to manage the effects of aging, the structures monitoring program is to include provisions to address protective coating monitoring and maintenance.	No	Structures Monitoring Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel 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 – BWR Program	Consistent with the GALL Report (see SER Section 3.5.2.1.4)
Steel components: piles (3.5.1-79)	Loss of material due to corrosion	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring Program	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
Structural bolting (3.5.1-80)	Loss of material due to general, pitting and crevice corrosion	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring Program	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 Program	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 Program	Consistent with the GALL Report
Structural bolting (3.5.1-83)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Consistent with the GALL Report (see SER Section 3.5.2.1.5)
Structural bolting (3.5.1-84)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Not applicable	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
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	Not applicable to Fermi 2 (see SER Section 3.5.2.1.1)
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 Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 Program	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 Program	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	Not applicable	Not applicable to BWRs (see SER Section 3.5.2.1.1)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-90)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water, and Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Water Chemistry Control – BWR and Inservice Inspection - IWF programs	Consistent with the GALL Report (see SER Section 3.5.2.1.6)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-91)	Loss of material due to general and pitting corrosion	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Inservice Inspection – IWF Program	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 programs	Consistent with the GALL Report (see SER Section 3.5.2.1.7)
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 Program	Consistent with the GALL Report (see SER Section 3.5.2.1.8)
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 Program	Consistent with the GALL Report (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	None	Consistent with the GALL Report

3.5.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.5.2.1, as amended by letter dated May 9, 2016, identifies the materials, environments, AERMs, and the following programs that manage aging effects for the structures and component supports components:

- Containment Inservice Inspection – IWE
- Containment Leak Rate
- External Surface Monitoring
- Fire Protection
- Fire Water System
- Inservice Inspection – IWF
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Periodic Surveillance and Preventive Maintenance
- Protective Coating Monitoring and Maintenance
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring
- Water Chemistry Control – BWR

LRA Tables 3.5.2-1 through 3.5.2-4 summarize AMRs 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 of 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 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 reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.5.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.5.1, items 3.5.1-25, and 3.5.1-89, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed these items only apply to PWRs; and finds that these items are not applicable to Fermi 2, which is a BWR.

For LRA Table 3.5.1, items 3.5.1-15, 3.5.1-16, 3.5.1-17, 3.5.1-18, 3.5.1-19, 3.5.1-20, 3.5.1-21, 3.5.1-22, 3.5.1-23, 3.5.1-24, 3.5.1-27, 3.5.1-32, 3.5.1-37, 3.5.1-38, 3.5.1-40, 3.5.1-62, 3.5.1-74, 3.5.1-84, and 3.5.1-85, the applicant claimed that the corresponding items in the GALL Report are not applicable or not used because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another Table 1 line item. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items or that the aging effects addressed by other Table 1 AMR line items are appropriate.

For LRA Table 3.5.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable or not used. However, the staff had to review sources beyond the LRA and UFSAR or to issue one or more RAIs, or both, to verify the applicant's claim.

LRA Table 3.5.1, item 3.5.1-36, addresses the steel drywell head and downcomers exposed to an air-indoor uncontrolled environment. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," to manage fretting or lockup due to mechanical wear for this component group. The applicant stated that this item is not applicable because "the drywell head is a stationary or fixed component and the downcomers are stationary, well-braced components and the spatial distance between connecting components makes it unlikely for fretting and lock up to occur." However, the staff noted that UFSAR Section 3.8.2.1.3.6, "Access for Refueling Operations," states that the drywell head is removed during refueling operations and is held in place by bolts and sealed with a double seal, which makes the drywell head a nonstationary or nonfixed component. Therefore, by letter dated December 23, 2014, the staff issued RAI 3.5.1.36-1, requesting that the applicant clarify whether the drywell head is fixed or removable and, if it is removable, state how fretting of lockup due to mechanical wear will be adequately managed during the period of extended operation.

In its response dated January 26, 2015, the applicant stated that the drywell head is a fixed component during plant operation and is removed during refueling operation cycles, as described in the Fermi 2 UFSAR Section 3.8.2.1.3.6. The applicant also stated that the movement is limited to the drywell head and the mating surfaces on the drywell shell during the drywell head removal and reinstallation cycle. However, this cycle does not involve oscillatory movements that could cause fretting and lockup, and although wear can occur in parts that experience intermittent relative motion or frequent manipulation, the removal and reinstallation cycle is infrequent. The applicant further stated that drywell head bolts are torqued during installation and verified with plant procedure using specific torque values that preclude movement between the drywell head and the drywell shell. Thus, fretting and lockup is not an AERM for the drywell head surfaces.

The staff finds the applicant's response acceptable because the drywell head is in a fixed condition during plant operation with the head bolts torqued to preclude movement between surfaces and because the infrequent (typically once per refueling cycle) manipulation of the drywell head only during the removal and reinstallation cycle for refueling does not provide the aging mechanisms necessary for the aging effects of fretting and lockup to occur. The staff also noted that the applicant's LRA credits the Containment Inservice Inspection - IWE and the Containment Leak Rate programs to detect the aging effects of loss of material in steel elements of the drywell shell and drywell head. The staff's concern described in RAI 3.5.1.36-1 is resolved. Therefore, the staff finds the applicant's claim for LRA Table 3.5.1, item 3.5.1-36, acceptable.

LRA Table 3.5.1, item 3.5.1-68, addresses low-alloy steel (actual measured yield strength equal or greater than 150 ksi), high-strength structural bolting exposed to an air-indoor uncontrolled environment. 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 there are no high-strength bolts subject to a sustained high tensile stress in a corrosive environment and "high strength structural bolts in civil structures have not shown to be prone to SCC." In its review of the applicant's Inservice Inspection – IWF Program, the staff issued RAI B.1.22-1, by letter dated December 19, 2014, requesting, in part, that the applicant provide additional information regarding the environment to which high-strength bolts are exposed to evaluate the applicant's claim that SCC in high-strength bolts is not an AERM at Fermi 2. The staff's review of the applicant's response to RAI B.1.22-1 is documented in SER Section 3.0.3.2.12. In its response to RAI B.1.22-1, dated February 19, 2015, the applicant stated that high-strength bolts are located in the lower area of drywell bioshield annulus. The applicant clarified that in this location the high-strength bolts are exposed to a dry and relatively cool (low-temperature) environment. The applicant also stated that the lubricant used for the bolts does not contain MoS_2.

The staff needed additional clarification on the applicant's response regarding whether the applicant inspects the drywell bioshield annulus area such that it can verify that the environment is kept dry. Therefore, during a telephone conference call held on March 6, 2015, the staff asked the applicant if it inspects the drywell bioshield annulus area. The applicant stated that the drywell bioshield annulus area is inspected every RFO. The staff notes that SCC cracking has been commonly found in high-strength bolts that are subject to an undesirable combination of high tensile stress, wet environment, and the presence of a corrosive agent (e.g., MoS_2). The staff noted that the drywell bioshield annulus area is a dry environment that is inspected by the applicant every RFO and that 100 percent of the support bolts are visually inspected (VT-3) every 10 years as required per Table IWF-2500-1 for Class 1 supports (supports other than piping supports). The staff evaluated the applicant's RAI response and finds it acceptable because high-strength bolts at Fermi 2 are not subject to conditions (e.g., wet environment and corrosive agents) conducive to SCC.

LRA Table 3.5.1, item 3.5.1-69, addresses high-strength structural bolting exposed to air-indoor uncontrolled or air-outdoor environment. The GALL Report recommends GALL Report AMP XI.S6 to manage cracking due to SCC for this component group. The applicant stated that this item is not applicable because "Fermi 2 does not have high strength bolts that are subject to sustained high tensile stress in a corrosive environment." The applicant also stated that "high strength bolts used in civil structures have not shown to be prone to SCC." The applicant's response to RAI B.1.42-4, dated December 26, 2014, further stated that high-strength structural bolts greater than 1 inch in diameter (other than ASTM A325, F1852, and A490 bolts) are not used in Fermi 2 structures with the exception of high-strength bolts used in the drywell stabilizer assembly. These high-strength bolts are type ASTM A325 bolting, which is not shown to be prone to SCC according to the recommendation in the GALL Report. The staff evaluated the applicant's claim and finds it acceptable because the applicant does not have high-strength structural bolting with the necessary material and environment combination for this aging effect to occur. The staff's review and evaluation of the applicant's response to RAI B.1.42-4 is documented in SER Section 3.0.3.2.22, "Structures Monitoring Program."

LRA Table 3.5.1, items 3.5.1-75 and 3.5.1-76, address sliding surfaces of Lubrite® exposed to an air-indoor uncontrolled or air-outdoor environment. For item 3.5.1-75, the GALL Report recommends GALL Report AMP XI.S3 to manage loss of mechanical function due to corrosion, distortion, dirt, debris, overload, and wear for this component group. For item 3.5.1-76, the GALL Report recommends GALL Report AMP XI.S6 to manage loss of mechanical function due to corrosion, distortion, dirt, overload, and wear for this component group. The applicant stated that these items are not applicable because "[l]ubrite plates are not subject to aging management because the listed aging mechanisms are event driven and typically can be avoided through proper design. Loss of material which could cause loss of mechanical function is addressed under Item 3.5.1-77 related to component support members."

The staff notes that the applicant plans to manage aging effects on Lubrite® sliding surfaces with item 3.5.1-77 (GALL Report, item III.A2.TP-302) through the Structures Monitoring Program for loss of material due to corrosion, which the applicant states could cause loss of mechanical function. The staff also notes that the applicant's program, with enhancements, will be consistent with GALL Report AMP XI.S6. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.22.

The staff evaluated the applicant's claim and finds it acceptable because the GALL Report states that Lubrite® is "characterized as maintenance-free" but emphasizes its proper installation to reduce the likelihood of functional problems during challenging loading conditions, and that it may require examinations. The GALL Report also states that the Structures Monitoring Program manages sliding surfaces for loss of material due to wear or corrosion and aging effects due to debris or dirt. According to Lubrite® Technologies, Lubrite® sliding surfaces, by design, prevent foreign matter contamination of the surfaces, and the U.S. Army Corps of Engineers (USACE) confirms that "Lubrite products have been used with uniform success" in challenging environments. The staff's search of the applicant's operating experience database during the audit yielded no results for Lubrite®, indicating that operating experience involving Lubrite® that warranted corrective action has not been identified. Thus, the staff determines that loss of mechanical function due to distortion, dirt, debris, overload, or wear would be an event-driven phenomenon and that visual inspections required by the Structures Monitoring Program would detect the aging effect of loss of material, which would serve as a leading indicator for identifying loss of mechanical function of Lubrite® sliding surfaces.

LRA Table 3.5.1, item 3.5.1-79, addresses steel components from piles exposed to groundwater or soil environments. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to manage loss of material due to corrosion for this component group. In its response to RAI B.1.39-2, dated December 26, 2014, the applicant stated that this item is not applicable because steel piles at Fermi 2 do not perform a license renewal intended function. The staff evaluated the applicant's response and finds it acceptable because a staff review of the referenced Figure 2.4-22, "Shore Barrier Design," and UFSAR Subsections 2.4.5, "Probable Maximum Surge and Seiche Flooding," and 3.4.4, "Flood Protection," verified that the steel sheet piles are not credited as part of the shore barrier function (i.e., required for stability) and confirms that the steel sheet piles were installed as a QA Level III component. The staff's evaluation of the applicant's response to RAI B.1.39-2 is provided in SER Section 3.0.3.2.20.

3.5.2.1.2 Loss of Sealing Due to Deterioration of Seals, Gaskets, and Moisture Barriers (Caulking, Flashing, and Other Sealants)

LRA Table 3.5.1, items 3.5.1-26 and 3.5.1-72, address the spent fuel storage pool gate rubber (elastomer) gasket/seal exposed to an air-indoor uncontrolled environment and a fluid environment, respectively, which will be managed for loss of sealing due to deterioration, wear, damage, erosion, tear, surface cracks, or other defects. For the AMR items that cite generic note E, the LRA credits the existing plant-specific PSPM Program to manage the loss of sealing aging effect for the spent fuel storage pool gate rubber gasket/seal. The GALL Report recommends GALL Report AMP XI.S1 "ASME Section XI, Subsection IWE" and/or AMP XI.S6 "Structures Monitoring" to ensure that this aging effect is adequately managed. GALL Report AMP XI.S1 recommends using general visual inspections by qualified personnel every 3 to 4 years to examine moisture barriers for wear, damage, erosion, tear, or other defects to manage the loss of sealing aging effect. GALL Report AMP XI.S6 recommends monitoring elastomeric structural sealants for cracking, loss of material, and hardening using visual inspections supplemented by feel to detect hardening on a frequency not to exceed 5 years to manage the loss of sealing aging effect.

The staff's evaluation of the applicant's existing plant-specific PSPM Program, as described in LRA Section B.1.35, is documented in SER Section 3.0.3.3.1. The staff noted that the PSPM Program proposes to manage the effects of aging (i.e., loss of sealing) for the rubber gasket/seal for spent fuel storage pool gates in the reactor building through the use of visual inspections and manual flexing performed at least once every 5 years. Based on its review of components associated with LRA Table 3.5.2-1, items 3.5.1-26 and 3.5.1-72, for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM Program acceptable because the program will effectively manage loss of sealing for the rubber gasket/seal of the spent fuel storage pool gates located in the reactor building by visually inspecting the surface condition and by having qualified personnel manually flex (to assess hardening) these elastomeric components at intervals not exceeding 5 years, which is consistent with the recommendations in the GALL Report.

The staff concludes that for LRA items 3.5.1-26 and 3.5.1-72, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.3 Increase in Porosity and Permeability and Loss of Strength Due to Leaching of Calcium Hydroxide and Carbonation

LRA Table 3.5.1, item 3.5.1-63, addresses above- and below-grade accessible areas of concrete and foundation for Groups 1–3, 5, and 7–9 structures exposed to flowing water. The GALL Report recommends GALL Report AMP XI.S6 to manage an increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation for this component group. The applicant originally stated that this item is not applicable because Fermi 2 Category 1 structures are founded on bedrock; structures do not use porous concrete subfoundations, do not rely on a dewatering system to control settlement, and do not have water flowing underneath the foundation. However, by letter dated January 26, 2015, in response to RAI 3.5.2.2.2.1-3, the applicant revised LRA Sections A.1.42 and B.1.42 (LRA Commitment Nos. 34m and 34n) to manage the potential aging effects of increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation for inaccessible areas based on testing and evaluation of observed conditions of in-leakage (water and mineral deposits) in accessible areas, which suggests that LRA Table 3.5.1, item 3.5.1-63, might be applicable. Therefore, by letter dated April 22, 2015, the staff issued followup RAI 3.5.2.2.2.1-3a, requesting that the applicant clarify and/or reconcile the inconsistencies between LRA Commitments No. 34, items m and n, and the nonapplicability of LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, and provide the Table 2 line items for the structures and components associated with this aging effect. Alternatively, the staff requested that the applicant provide the technical basis to justify why LRA Table 3.5.1, items 3.5.1-63 and 3.5.1-47, continue to remain not applicable. The staff's evaluation of the applicant's response to followup RAI 3.5.2.2.2.1-3a and applicability of LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, is provided in SER Section 3.5.2.2.2.

3.5.2.1.4 Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-78, addresses steel components – spent fuel pool liner exposed to a fluid environment, 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 Water Chemistry Control – BWR Program and "monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels" to manage the aging effects for these components. The GALL Report recommends AMP 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.

During its review of components associated with item 3.5.1-78, which cites generic note E, the staff noted that the applicant applied this item to components other than the spent fuel pool liner. These fuel pool components (e.g., reactor cavity liner, refueling bellows, and skimmer surge tank) are only flooded during refueling, and leakage may not reveal cracking or corrosion. Therefore, monitoring of the spent fuel pool water level and leak chase channel, although recommended by the GALL Report, may not be appropriate to verify the effectiveness of the water chemistry program in these components. Additionally, it was unclear to the staff why the applicant does not manage the aging effect of cracking for these items. By letter dated December 17, 2014, the staff issued RAI 3.5.2.78-1 requesting that the applicant clarify how the effectiveness of the Water Chemistry Control – BWR Program will be verified for these Table 3.5.2-1 components that reference LRA Table 3.5.1, item 3.5.1-78, generic note E, and state the basis for why cracking was not being managed for these components.

In its response dated January 15, 2015, the applicant stated that the Water Chemistry Control – BWR Program references the One-Time Inspection Program to verify the effectiveness of water chemistry control for managing the applicable aging affects. The letter also states that the stainless steel components, which reference item 3.5.1-78, are exposed to treated water that is less than 140 F, which is not an environment conducive to SCC; therefore, cracking does not need to be managed in this case.

The staff reviewed the applicant's statement that the stainless steel components, which reference item 3.5.1-78, are exposed to water that is less than 140 °F and, therefore, are not susceptible to cracking. However, a review of the UFSAR found that, under normal operating conditions, the spent fuel pool is maintained at a temperature less than or equal to 125 °F and 150 °F during RFOs. For stainless steel components exposed to treated water greater than 140 °F, the GALL Report recommends GALL Report AMPs XI.M2 and XI.M32, "One-Time Inspection."

The staff finds the applicant's response acceptable because the LRA states that the Water Chemistry Control – BWR Program uses the One-Time Inspection Program as verification of effectiveness of the water chemistry controls to mitigate cracking, which is consistent with the GALL Report for stainless steel components exposed to treated water greater than 140 °F (e.g., item 3.4.1-11). The staff's concern described in RAI 3.5.2.78-1 is resolved.

The staff concludes that, for LRA Table 3.5.1, item 3.5.1-78, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.5 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-83, addresses structural bolting exposed to a fluid environment and air-indoor uncontrolled or air-outdoor environments, which will be managed for loss of material due to general, pitting, and crevice corrosion. The GALL Report recommends GALL Report AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with

Nuclear Power Plants" or the Federal Energy Regulatory Commission (FERC)/USACE dam inspections and maintenance programs to ensure that this aging effect is adequately managed.

During its review of components associated with item 3.5.1-83 for which the applicant cited generic note A, the staff noted that the LRA credits the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program to manage the aging effect for stainless steel anchor bolts exposed to fluid environment. However, sufficient information had not been provided to adequately determine whether stainless steel anchor bolts are exposed to an environment conducive to SCC because the LRA environment description for "Exposed to Fluid Environment" corresponds to a broad list of environment types that includes environments with treated water and/or treated water with temperature above 140 °F, which makes a stainless steel material susceptible to SCC. Therefore, by letter dated November 25, 2014, the staff issued RAI 3.5.1.83-1, requesting that the applicant clarify the fluid environment to which these anchor bolts are exposed, including temperature and water chemistry, and state how the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program will adequately manage this aging effect if the anchor bolts are exposed to an environment conducive to SCC.

In its response dated December 26, 2014, the applicant stated that the fluid environment in which the stainless steel anchor bolts are exposed is raw water from Lake Erie with temperatures less than 140 °F and water chemistry similar to groundwater. The applicant provided some key water chemistry parameters of Lake Erie water obtained from a recent water quality study performed at Fermi 2 between 2008 and 2009, as described in Table 2, "Summary of Surface Water Quality Data Collected at Sampling Location LE1-W" (ADAMS Accession No. ML093380411) and further stated that these anchor bolts are not exposed to an environment with a significant presence of contaminants, specifically chlorides, and that normal temperature limits of the fluid environment to which these anchor bolts are exposed is less than the SCC threshold of 140 °F. The applicant also stated that, based on these considerations, the stainless steel anchor bolts listed in LRA Table 3.5.2-4, exposed to a fluid environment, are not in an environment conductive to SCC and that cracking due to SCC is not an AERM for these stainless steel anchor bolts.

The staff finds the applicant's response acceptable because it clarified that the fluid environment in which the anchor bolts are exposed is not a harsh environment. Rather, normal temperature limits are less than the threshold of 140 °F for SCC, and no stagnant, oxygenated, or borated water is present that would allow SCC to occur. Because the anchor bolts are not exposed to environment conductive to SCC, aging effects from anchor bolts exposed to an environment conductive to SCC is not considered a credible aging effect required to be manage, as recommended by the GALL Report. The staff's concern described in RAI 3.5.1.83-1 is resolved.

The staff concludes that for LRA Table 3.5.1, item 3.5.1-83, the applicant has demonstrated that the effects of aging for these components will be adequately managed and that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.6 Loss of Material Due to General (Steel Only), Pitting, and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-90 addresses steel and stainless steel support members, welds, bolted connections, and support anchorage to building structure components exposed to a treated water environment less than 60 °C (140 °F), which will be managed for loss of material due to general (steel only), pitting, and crevice corrosion. The LRA states that item 3.5.1-90 is consistent with the GALL Report. The SRP-LR states that item 3.5.1-90 corresponds to GALL Report, item III.B1.1.TP-10. The GALL Report recommends GALL Report AMPs XI.M2, "Water Chemistry," and XI.S3, "ASME Section XI, Subsection IWF," to ensure that this aging effect is adequately managed.

LRA Tables 3.5.2-1, "Reactor/Auxiliary Building and Primary Containment Summary of Aging Management Evaluation," and 3.5.2-4, "Bulk Commodities Summary of Aging Management Evaluation," assign item 3.5.1-90 for the AMRs of carbon vent header support and stainless steel anchorage/embedments components exposed to a fluid environment, which will be managed for loss of material by the Water Chemistry Control – BWR and Inservice Inspection – IWF programs. For the carbon vent header support, the LRA cites note A, indicating that the AMR item combination of component, material, environment, aging effect, and assigned AMPs are consistent with those recommended in the GALL Report. For the stainless steel anchorage/embedments components, the LRA cites note C, indicating that the AMR item component is different but consistent with the material, environment, aging effect, and AMP recommended in the GALL Report.

During its review of the AMR items, the staff confirmed the applicant's claims of consistency with the GALL Report with respect to material, environment, aging effect, and recommended AMPs; however, additional information was needed to confirm that the environment description is consistent with the GALL Report. The staff noted that LRA Table 3.0-2, "Service Environments for Structural Aging Management Reviews," states, in part, that the "exposed to fluid environment" corresponds to the GALL Report environment of treated water greater than 140 °F. However, GALL Report, AMR item III.B1.1.TP-10, addresses steel and stainless steel components exposed to an environment of treated water less than 140 °F. It was not clear how the LRA description of an "exposed to fluid environment" was consistent with an environment of treated water less than 140 °F. In addition, for stainless steel components exposed to treated water greater than 140 °F, the GALL Report states that cracking is an aging effect that should be subject to age management. It was not clear whether stainless steel anchorage/embedment components, if exposed to treated water greater than 140 °F, will be managed for cracking. Therefore, by letter dated January 14, 2015, the staff issued RAI 3.5.1.90-1, requesting that the applicant (1) clarify how its characterization of "exposed to fluid environment," defined in the LRA, is consistent with an environment of treated water less than 140 °F in GALL Report, AMR item III.B1.1.TP-10, and (2) state how the aging effects of cracking for anchorage/embedments stainless steel components exposed to treated water greater than 140 °F will be adequately managed during the period of extended operation.

In its response dated February 12, 2015, the applicant stated that the "exposed to fluid environment" in LRA Table 3.0-2 encompass several raw and treated water environments, including both treated water greater than 140 °F and treated water less than 140 °F. The applicant clarified that the components in LRA Tables 3.5.2-1 and 3.5.2-4 that are listed as "exposed to fluid environment" and consistent with GALL Report, AMR item III.B1.1.TP-10, are in an environment of treated water less than 140 °F. The applicant also stated that the anchorage/embedments stainless steel components do not need to be age managed for SCC because the treated water in a less than 140 °F environment is not conducive to this aging effect. The staff finds the applicant's response acceptable because it clarified that the components are in an environment of treated water less than 140 °F, which makes the AMR of these components consistent with GALL Report, AMR item III.B1.1.TP-10 and, therefore, not subject to the aging effect of cracking due to the environment. The staff's concerns described in RAI 3.5.1.90-1 are resolved.

The staff concludes that, for LRA Table 3.5.1, item 3.5.1-90, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.7 Loss of Material Due to General and Pitting Corrosion

LRA Table 3.5.1, item 3.5.1-92 addresses steel support members; welds; bolted connections; support anchorage to building structure exposed to an air-indoor uncontrolled or air-outdoor environment, which will be managed 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 GALL Report AMP XI.S6, “Structures Monitoring,” to ensure that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using periodic visual inspections by qualified personnel, at a frequency not to exceed 5 years, to monitor steel components for loss of material to manage the effects of aging.

The staff’s evaluation of the applicant’s Fire Water System Program is documented in SER Section 3.0.3.2.10. The staff noted that the Fire Water System Program, as revised by letter dated July 30, 2014, proposes to manage the effects of aging for fire suppression system components through the use of periodic visual inspections. The LRA states that the Fire Water System Program includes visual inspection techniques capable of detecting loss of material due to corrosion and that the acceptance criteria include no unacceptable signs of degradation observed during visual inspections. Based on its review of components associated with LRA Table 3.5.1, 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 the carbon steel fire hose reels will be subject to periodic visual inspections to detect loss of material at a frequency not to exceed 5 years, which is consistent with the recommendations in GALL Report AMP XI.S6.

The staff concludes that, for LRA Table 3.5.1, 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(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 Due to Pitting and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-93, addresses support members, welds, bolted connections, and support anchorage for building structures exposed to an air-outdoor environment, which will be managed for loss of material due to pitting and crevice corrosion. For the AMR item that cites generic note E, the LRA credits the Inservice Inspection – IWF Program to manage the aging effect for stainless steel structural bolting. The GALL Report recommends GALL Report AMP XI.S6 “Structures Monitoring” to ensure that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using periodic visual inspections to manage the effects of aging.

The staff’s evaluation of the applicant’s Inservice Inspection – IWF Program is documented in SER Section 3.0.3.2.12. The staff noted that the Inservice Inspection – IWF Program proposes to manage the effects of aging for component supports associated with ASME Code Class 1, 2, 3 and MC piping through the use of periodic visual examination. Because the Inservice Inspection – IWF Program is associated with ASME Code Class 1, 2, 3 and MC piping and other components as opposed to the components described in the GALL Report for this line item, it was not clear whether the AMR line item in LRA Table 3.5.2-4 was intended to address stainless steel structural bolting under ASME Code Section XI, Subsection IWF component supports or non-ASME Code component supports. Therefore, by letter dated December 23, 2014, the staff issued RAI 3.5.1.93-1 requesting that the applicant clarify whether the stainless steel structural bolting is associated with ASME Code Section XI, Subsection IWF components or non-ASME Code component supports and, if it is associated with non-ASME Code component supports, clarify whether the stainless steel structural bolting is within the scope of the Inservice Inspection – IWF Program.

In its response dated January 26, 2015, the applicant stated that the stainless steel structural bolting was intended for ASME Code Section XI, Subsection IWF components because SRP-LR Table 3.5-1, item 91, is associated with steel components rather than stainless steel components. The applicant also stated that, after further review of drawings following this RAI, no stainless steel bolting in scope of the Inservice Inspection – IWF Program was identified to be exposed to an air-outdoor environment. Therefore, the applicant revised LRA Table 3.5.2-4 to delete the line item associated with stainless steel structural bolting exposed to an air-outdoor environment.

The staff evaluated the applicant's response and finds it acceptable because the applicant clarified that there is no stainless steel bolting in the scope of the Inservice Inspection – IWF Program that is exposed to an air-outdoor environment. The applicant revised LRA Table 3.5.2-4 accordingly and deleted the line item with generic note E that corresponds to LRA Table 3.5.1, item 3.5.1-93. The staff's concern described in RAI 3.5.1.93-1 is resolved.

3.5.2.1.9 Reduction or Loss of Isolation Function Due to Radiation Hardening, Temperature, Humidity, and Sustained Vibratory Loading

LRA Table 3.5.1, item 3.5.1-94 addresses nonmetallic (e.g., rubber) vibration isolation elements exposed to an air-indoor uncontrolled environment, 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 isolation components. The GALL Report recommends GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF," to ensure that this aging effect is adequately managed. To manage the effects of aging, GALL Report AMP XI.S3 recommends that elastomeric vibration isolation components (1) be monitored for cracking, loss of material, and hardening and (2) be subject to visual examinations supplemented by feel to detect hardening if the vibration isolation function is suspect. The GALL Report AMP XI.S3 also states that the condition of elastomeric vibration isolation components is unacceptable if there is loss of material, cracking, and hardening that could reduce their vibration isolation function.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.22. The LRA states that the Structures Monitoring Program is consistent, with enhancement, with GALL Report AMP XI.S6, "Structures Monitoring." The staff noted that the Structures Monitoring Program proposes, through its enhancements to the "parameters monitored or inspected" and "detection of aging effects" program elements, to manage the effects of aging for elastomeric vibration isolators by (1) monitoring parameters, such as cracking, loss of material, and hardening, and (2) supplementing visual inspections by feel to detect hardening when the intended function of the elastomeric material is suspect. Based on its review of components associated with LRA Table 3.5.1, 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 Structures Monitoring Program acceptable because, consistent with the recommendation in the GALL Report, elastomeric vibration isolation components will be inspected for cracking, loss of material, and hardening and will be subject to visual examinations supplemented by feel to detect hardening.

The staff concludes that, for LRA Table 3.5.1, item 3.5.1-94, 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).

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation Is Recommended

In LRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the structures and component supports components and provides information concerning how it will manage aging effects in the following three areas:

(1) PWR and BWR containments

- cracks 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 of concrete structures due to elevated temperature
- aging management of inaccessible areas for Group 6 structures
- cracking due to SCC and loss of material due to pitting and crevice corrosion
- cumulative fatigue damage due to fatigue

(3) QA for aging management of nonsafety-related components

(4) ongoing review of operating experience

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.5.2.2. The staff's review of the applicant's further evaluation follows.

3.5.2.2.1 PWR and BWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which address several areas listed below.

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. LRA Section 3.5.2.2.1.1 is also associated with LRA Table 3.5.1, item 3.5.1-2, which addresses reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation in concrete foundation and subfoundation exposed to flowing water. The criteria in SRP-LR Section 3.5.2.2.1.1 state that, for PWR and BWR containments, the GALL Report recommends further evaluation for aging management of (1) cracking and distortion due to settlement and (2) reduction of foundation strength and cracking if a dewatering system is used to control settlement. The SRP-LR also states that, when a dewatering system to control settlement is in place, its functionality should be monitored through ASME Code Section XI, Subsection IWL, or the Structures Monitoring Program.

The applicant stated that these items are not applicable because the Fermi 2 containment base foundation consists of a concrete bed founded on bedrock with no porous concrete subfoundation and because the site "does not rely on a de-watering system for control of settlement." The staff reviewed the Fermi 2 UFSAR and confirmed that there is no dewatering system credited for settlement control at the site. The staff evaluated the applicant's claim and finds it acceptable because (1) Fermi 2 containment concrete base foundation is founded on bedrock, which does not allow for settlement, (2) the subfoundation is not made of porous concrete, and (3) there is no dewatering system for control of settlement at the site.

Reduction of Strength and Modulus due to Elevated Temperature. 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 due to elevated temperature in concrete, including the dome, wall, basemat, ring girders, buttresses, containment, and/or fill-in annulus exposed to elevated temperature. The criteria in SRP-LR Section 3.5.2.2.1.2 state that further evaluation of a plant-specific AMP is recommended if any portion of the concrete containment components exceeds the specified temperature limits of more than 150 °F in a general area and more than 200 °F in local areas. The SRP-LR also states that implementation of 10 CFR 50.55a and ASME Code Section XI, Subsection IWL, would not be able to identify this aging effect; however, higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and if these reductions are applied to the design calculations. The applicant stated that these aging effects and mechanisms are not applicable to the Fermi 2 primary containment because the concrete base foundation elements are integral with the reactor building foundation and are not exposed to general temperatures that exceed the specified threshold.

Further, the applicant stated that the GALL Report item is not associated with the Fermi 2 BWR Mark I steel containment structure type. The staff reviewed UFSAR Sections 3.8.2.1.3.1 and 9.4 and confirmed that normal operating temperatures in containment are maintained below the specified threshold in the GALL Report for general and local areas of concrete. Therefore, the steel containment base foundation concrete elements are not exposed to the environment required for this aging effect to occur. The staff evaluated the applicant's claim and finds it acceptable because this aging effect is applicable to concrete containment structures and because Fermi 2 has a Mark I carbon steel containment structure type.

Loss of Material Due to General, Pitting, and Crevice Corrosion. LRA Section 3.5.2.2.1.3, associated with LRA Table 3.5.1, items 3.5.1-4 through 3.5.1-7, addresses the following:

(1) LRA Section 3.5.2.2.1.3, item 1, associated with LRA Table 3.5.1, items 3.5.1-4 and 3.5.1-5, addresses steel elements (inaccessible areas), including drywell shell, drywell head, and drywell shell in sand pocket region, and steel elements (inaccessible areas), including the suppression chamber, respectively, exposed to an air-indoor, uncontrolled environment or concrete, 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, state 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 existing program relies on ASME Code, Section XI, Subsection IWE, and Appendix J to 10 CFR Part 50 to manage this aging effect. The SRP-LR also states that the GALL Report recommends further evaluation of plant-specific programs to manage this aging effect if corrosion is indicated from the IWE examinations. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the moisture barrier provided at the concrete-to-steel interface where the drywell shell becomes embedded in the concrete floor within the drywell is inspected in accordance with ASME Code, Section XI, Subsection IWE. The applicant also stated that, to prevent corrosion, the interior and exterior surfaces of the lower drywell shell are protected from contact with the atmosphere by complete concrete encasement, and because the concrete is over 8 feet thick and is placed in multiple horizontal layers, it is not credible for water to reach the drywell shell even if a crack is assumed. The interior concrete is monitored for cracks using the Structures Monitoring Program. The applicant further stated that the drywell sand cushion area contains drains to protect the exterior surface of the drywell shell at the sand cushion interface from water that might enter the air gap. Additionally, the applicant explained that significant corrosion of the drywell is not expected because the drywell shell exterior has galvanic corrosion protection and because inspection activities ensure that excessive moisture levels on the exterior of the drywell shell are identified. The applicant concluded that the continued monitoring of the Fermi 2 steel containment using the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program provides reasonable assurance that loss of material due to corrosion in inaccessible areas will be detected before loss of intended function and that a plant-specific program is not necessary.

In its review of components (i.e., steel elements (inaccessible areas), including the drywell shell, drywell head, and drywell shell in the sand pocket region) in LRA Table 3.5.2-1, associated with item 3.5.1-4 and generic note C, the staff noted that the AMR results item listed item II.B.1.1.CP-63 as the corresponding GALL Report line item. However, this line item did not correspond to the GALL Report line item (i.e., item II.B3.1.CP-113) referenced in SRP-LR Table 3.5.1, item 3.5.1-4. Further, the staff could not find an item designated item II.B.1.1.CP-63 in the GALL Report. By letter dated December 22, 2014, the staff issued RAI 3.5.2.2.1.3.1-1 requesting that the applicant identify the appropriate AMR item in the GALL Report that would apply to the material, environment, and aging effect being managed by the AMR item in LRA Table 3.5.2-1 mentioned above for inaccessible areas of the Fermi 2 steel drywell, including the portion of the shell embedded in concrete.

In its response dated January 30, 2015, the applicant stated that LRA Table 3.5.1, item 3.5.1-4, remains the appropriate Table 1 item and identified the corresponding GALL Report item as item II.B3.1.CP-113, which is listed under Mark III steel containments. The applicant explained that GALL Report, item II.B3.1.CP-113, is appropriate for the drywell inaccessible areas of the Fermi 2 Mark I containment because, in addition to an air-indoor uncontrolled environment, it includes concrete as an environment, which addresses the inaccessible portion of the Fermi 2 drywell shell that is embedded in concrete. The applicant revised the corresponding line item in LRA Table 3.5.2-1 to include concrete as an environment and to reference the GALL Report, item II.B3.1.CP-113.

The staff find's the applicant's response to RAI 3.5.2.2.1.3.1-1 appropriate because the GALL Report, item II.B3.1.CP-113, identified by the applicant, corresponds to the line item referenced in SRP-LR Table 3.5.1, item 3.5.1-4, and applies to the two environments (i.e., an air-indoor uncontrolled environment or concrete) in which the aging effect is required to be managed for inaccessible areas of the Fermi 2 steel drywell shell, including the portion embedded within the concrete floor. The staff's concern described in RAI 3.5.2.2.1.3.1-1 is resolved.

In its review of the applicant's evaluation in LRA Section 3.5.2.2.1.3, item 1, related to LRA Table 3.5.1, items 3.5.1-4 and 3.5.1-5, intended to address steel inaccessible areas of the drywell and the torus, respectively, the staff noted that the applicant had not addressed the plant-specific operating experience related to the loss of material due to corrosion of the inaccessible areas of the Fermi 2 primary containment (i.e., the drywell and the torus). The staff requested this information to determine whether a plant-specific AMP is necessary to manage the aging effect. By letter dated December 22, 2014, the staff issued RAI 3.5.2.2.1.3.1-2, requesting that the applicant describe the plant-specific operating experience related to loss of material due to general, pitting, and crevice corrosion of the drywell shell and torus of the Fermi 2 primary containment and address its significance to justify whether a plant-specific program is necessary to manage the aging effect.

In its response to RAI 3.5.2.2.1.3.1-2 dated January 30, 2015, with regard to the torus, the applicant clarified that there are no inaccessible areas of the torus; therefore, LRA Table 3.5.1, item 3.5.1-5, is not used for the aging effect. The applicant revised LRA Section 3.5.2.2.1.3, item 1, and LRA Table 3.5.1, item 3.5.1-5, to reflect this information about the torus and that accessible areas of the torus shell are addressed in LRA Table 3.5.1, item 3.5.1-6. The applicant also deleted the AMR line item for steel elements (inaccessible): torus shell in LRA Table 3.5.2-1 that referenced LRA Table 3.5.1, item 3.5.1-5. With regard to the drywell, the applicant clarified that the interior of the drywell shell is accessible for inspections except for beneath the concrete floor. The applicant also stated that the operating experience to date indicates that only one corrosion pit (0.02 inch by 0.04 inch by 0.093 inch deep) has been detected in the drywell shell that was attributed to a screw and uncoated washer in contact with an uncoated portion of the shell. The screw and washer were removed, and the drywell shell area in the pit was coated. The applicant further stated that the exterior drywell shell is inaccessible, except for the drywell dome, and that, to date, there is no operating experience related to loss of material due to corrosion of the exterior of the drywell shell.

Additionally, the applicant stated that no loss of material was indicated by ultrasonic thickness measurements taken in 2014 of the drywell shell in the sand cushion area. The applicant explained that an inspection on the normally inaccessible areas at the interface of the drywell shell and the concrete floor performed in 2010 during repair of the degraded moisture seal at the interface also did not identify loss of material due to corrosion of the drywell shell at the interface. The applicant concluded that a plant-specific AMP is not needed because the operating experience did not identify any significant loss of material due to corrosion of the drywell shell from the Containment Inservice Inspection Program – IWE inspections.

The staff reviewed UFSAR Section 3.8.2 and did not find any information indicating that any portion of the exterior or interior of the torus shell was inaccessible. The staff finds the applicant's response and "not used" (i.e., not applicable) disposition of LRA Table 3.5.1, item 3.5.1-5, acceptable because (a) there are no inaccessible areas in the Fermi 2 torus shell and (b) SRP-LR Table 3.5.1, item 5, does not make reference to a GALL Report item that applies directly to Mark I steel containments. With regard to the drywell shell, the staff notes that applicant's operating experience and ASME Code, Section XI, Subsection IWE inspections, including UT measurements, suggests that there is no significant loss of material of the Fermi 2 drywell shell due to general, pitting, or crevice corrosion in accessible and inaccessible areas to necessitate a plant-specific program to manage the aging effect. The staff finds the applicant's response with regard to the drywell shell (LRA Table 3.5.1, item 3.5.1-4) acceptable because the applicant's description of the plant-specific operating experience from ASME Code, Section XI, Subsection IWE examinations of accessible and inaccessible areas of the drywell shell, which indicate no significant loss of material due to corrosion, justified that a plant-specific program is not necessary to manage the aging effect. The staff's concerns described in RAI 3.5.2.2.1.3.1-2 are resolved.

The staff's evaluation of the applicant's Containment Inservice Inspection – IWE Program, with enhancements, and the Containment Leak Rate Program is documented in SER Sections 3.0.3.2.5 and 3.0.3.1.8, respectively. The staff noted that the programs ensure that corrosion of the drywell shell is detected and that corrective actions are taken before there is a loss of material that affects its ability to perform intended functions by using visual examinations of all accessible drywell areas, including moisture barriers at the interface of the steel shell and the concrete floor inside the drywell, at frequencies required by ASME Code, Section XI, Subsection IWE, and applicable regulations and by periodic leak rate testing in accordance with Appendix J to 10 CFR Part 50. Augmented examinations of the drywell shell, including inaccessible areas, are required if there are indications in accessible areas that degradation of inaccessible areas could also be occurring. The staff notes that the applicant's Containment Inservice Inspection – IWE Program includes enhancements (Commitment Nos. 9a, 9f, and 9g) related to aging management of potential loss of material due to corrosion in inaccessible areas on the exterior of its Mark I containment drywell shell. Additionally, as discussed in the staff evaluation of RAI 3.5.2.2.1.3.1-2, the staff notes that the Fermi 2 operating experience of the drywell shell indicates no significant loss of material due to corrosion; therefore, a plant-specific program is not necessary to manage the aging effect.

The staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the enhanced Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program is acceptable because the plant-specific operating experience from ASME Code, Section XI, Subsection IWE examinations indicates no significant loss of material due to corrosion in inaccessible areas of the Fermi 2 drywell shell and because the applicant's approach to managing the aging effect is consistent with the recommendations in GALL Report, item II.B3.1.CP-113, which corresponds to LRA Table 3.5.1, item 3.5.1-4.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.5.2.2.1.3, item 1, criteria. For those items associated with LRA Section 3.5.2.2.1.3, item 1, as amended by letter dated January 30, 2015, 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).

(2) LRA Section 3.5.2.2.1.3, item 2, associated with LRA Table 3.5.1 item 3.5.1–6, addresses steel elements: torus shell, exposed to air-indoor, uncontrolled or exposed to fluid environment, 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 2, state that loss of material due to general, pitting, and crevice corrosion could occur in the steel torus shell of Mark I containments. The existing program relies on ASME Code, Section XI, Subsection IWE, and Appendix J to 10 CFR Part 50 to manage this aging effect. The SRP-LR also states that the GALL Report recommends further evaluation of plant-specific programs to manage this aging effect if corrosion is significant. The GALL Report, item II.B1.1.CP-48, corresponding to SRP-LR Table 3.5 1, item 6, states, in part, "License renewal applicants are advised to address their plant-specific operating experience related to the torus shell corrosion. If the identified corrosion is significant, a plant-specific aging management is required." The applicant addressed the further evaluation criteria of the SRP-LR by stating that the continued monitoring of its Mark I containment steel torus shell for loss of material due to general, pitting, and crevice corrosion through the Containment Inservice Inspection – IWE Program by visual examination of accessible interior and exterior surfaces and through the Containment Leak Rate Program provides reasonable assurance that loss of material due to corrosion will be detected before a loss of intended function. The applicant also stated in LRA Section 3.5.2.2.1.3, item 1, as amended by its response to RAI 3.5.2.2.1.3.1-2, dated January 30, 2015, that the interior and exterior shell of the torus is accessible.

In its review of the applicant's evaluation in LRA Section 3.5.2.2.1.3, item 2, related to LRA Table 3.5.1, item 3.5.1-6, and the corresponding AMR results line in LRA Table 3.5.2-1 associated with loss of material due to corrosion of steel elements of the torus shell, the staff noted that the applicant had not addressed the plant-specific operating experience related to the loss of material due to corrosion of the torus shell, as recommended in the GALL Report. The staff needed this information to determine whether a plant-specific AMP is necessary to manage the aging effect. By letter dated December 22, 2014, the staff issued RAI 3.5.2.2.1.3.2-1, requesting that the applicant describe the plant-specific operating experience related to loss of material due to general, pitting, and crevice corrosion of the Fermi 2 steel torus shell and address its significance to justify whether a plant-specific program is necessary to manage the aging effect.

In its response to RAI 3.5.2.2.1.3.2-1, dated January 30, 2015, the applicant stated that only one 0.25-inch-diameter by 0.0285-inch-deep corrosion pit under a coating blister has been identified in the torus wetted area during the history of the plant; the coating was repaired. The applicant also stated that during the recent inspection performed in 2012, when 100 percent of the torus wetted and vapor space was inspected, no pitting of the torus primary containment boundary was identified. However, broken coating blisters, mechanical damage, and pin point rust areas were identified and repaired in the wetted areas of the torus. With regard to the vapor region, the applicant stated that all flaking paint was removed from the torus ring header, torus vacuum breaker valves, nitrogen supply lines, monorail rail, and torus walkway and handrail. The applicant explained that flaking or cracked coating was removed and protective coating reapplied to the torus shell. The applicant also stated that no loss of material due to corrosion of the exterior surface of the Fermi 2 torus shell has been identified to date. The applicant concluded that, because no significant loss of material due to corrosion has occurred in the torus shell, a plant-specific program is not needed to manage the aging effect. The applicant revised LRA Section 3.5.2.2.1.3, item 2, to reflect the above operating experience of the Fermi 2 torus shell.

The staff noted that LRA Section B.1.12 states that the torus is inspected in alternate RFOs, which is more frequent than that required by ASME Code, Section XI, Subsection IWE. LRA Section B.1.12 also states that the coating condition continues to be monitored and repaired, as necessary. Based on the torus shell thickness in the wetted region of 0.658 inch indicated in UFSAR Section 3.8.2, the single 0.0285-inch corrosion pit identified in the torus wetted area is less than the 5 percent of the torus shell thickness and is an insignificant loss of material. The staff notes that the applicant's operating experience description of the torus shell indicates no significant loss of material due to corrosion to necessitate a plant-specific program to manage the aging effect. The staff finds the applicant's response acceptable because the applicant provided a summary description of the operating experience of the Fermi 2 torus shell, which indicates no significant loss of material due to corrosion, and justified that a plant-specific program is not necessary to manage the aging effect on the torus shell. The staff's concern described in RAI 3.5.2.2.1.3.2-1 is resolved.

The staff's evaluation of the applicant's Containment Inservice Inspection – IWE Program, with enhancements, and the Containment Leak Rate Program is documented in SER Sections 3.0.3.2.5 and 3.0.3.1.8, respectively. The staff noted that the programs ensure that corrosion of the torus shell is detected and that corrective actions are taken before there is a loss of material that affects its ability to perform intended functions by using visual examinations of accessible and wetted torus areas at frequencies required by ASME Code, Section XI, Subsection IWE, and applicable regulations and by periodic leak rate testing in accordance with Appendix J to 10 CFR Part 50. Augmented examinations are specified as required. Additionally, as discussed in the staff evaluation of RAI 3.5.2.2.1.3.2-1, the staff notes that the Fermi 2 operating experience of the torus shell indicates no significant loss of material due to corrosion; therefore, a plant-specific program is not necessary to manage the aging effect. The staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the enhanced Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program is acceptable because the plant-specific operating experience indicates no significant loss of material due to corrosion of the Fermi 2 torus shell and because the applicant's approach to managing the aging effect is consistent with the recommendations in GALL Report, item II.B1.1.CP 48, which corresponds to LRA Table 3.5.1, item 3.5.1-6.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.5.2.2.1.3, item 2, criteria. For those items associated with LRA Section 3.5.2.2.1.3, item 2, as amended by letter dated January 30, 2015, 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) LRA Section 3.5.2.2.1.3, item 3, associated with LRA Table 3.5.1, item 3.5.1-7, and GALL Report, item II.B1.1.CP-109, addresses steel elements: torus ring girders; downcomers, exposed to air-indoor, uncontrolled or exposed to fluid environment, which will be managed for loss of material due to general, pitting, and crevice corrosion by the Containment Inservice Inspection – IWE Program. The criteria in SRP-LR Section 3.5.2.2.1.3, item 3, state that loss of material due to general, pitting, and crevice corrosion could occur in steel torus ring girders and downcomers of Mark I containments. The existing program relies on ASME Code, Section XI, Subsection IWE, to manage this aging effect. The SRP-LR also states that the GALL Report recommends further evaluation of plant-specific programs to manage this aging effect if plant operating experience identified significant corrosion. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the continued monitoring of its Mark I steel containment, including the steel torus ring girders and downcomers, for loss of material due to general, pitting, and crevice corrosion through the Containment Inservice Inspection – IWE Program by visual examination of accessible surfaces provides reasonable assurance that loss of material due to corrosion will be detected before a loss of intended function.

In its review of the applicant's evaluation in LRA Section 3.5.2.2.1.3, item 3, related to LRA Table 3.5.1, item 3.5.1-7, and the corresponding AMR results in LRA Table 3.5.2-1 associated with loss of material due to corrosion of steel torus ring girders and downcomers, the staff noted that the applicant had not addressed the plant-specific operating experience related to the loss of material due to corrosion of the torus shell, as recommended in the GALL Report. The staff needed this information to determine whether a plant-specific AMP is necessary to manage the aging effect. By letter dated December 22, 2014, the staff issued RAI 3.5.2.2.1.3.3-1, requesting that the applicant describe the plant-specific operating experience related to loss of material due to general, pitting, and crevice corrosion of the Fermi 2 steel torus ring girders and downcomers and address its significance to justify whether a plant-specific program is necessary to manage the aging effect.

In its response to RAI 3.5.2.2.1.3.3-1, dated January 30, 2015, the applicant stated that, to date, operating experience has identified no loss of material due to general, pitting, and crevice corrosion of the Fermi 2 steel torus ring girders and downcomers. The applicant concluded that a plant-specific program is not needed because corrosion has not been identified. The applicant revised LRA Section 3.5.2.2.1.3, item 3, to indicate that operating experience has identified no loss of material due to corrosion of the Fermi 2 torus ring girders and downcomers.

The staff finds the applicant's response acceptable because the applicant's operating experience description indicated no loss of material due to corrosion of the torus ring girders and downcomers, which justifies that a plant-specific program is not necessary to manage the aging effect. The staff's concern described in RAI 3.5.2.2.1.3.3-1 is resolved.

The staff's evaluation of the applicant's Containment Inservice Inspection – IWE Program, with enhancements, is documented in SER Sections 3.0.3.2.5. The staff noted that the program ensures that corrosion of the torus ring girders and downcomers is detected and that corrective actions are taken before there is a loss of material that affects its ability to perform intended functions by using visual examinations of accessible and wetted torus areas at frequencies required by ASME Code, Section XI, Subsection IWE, and applicable regulations. Augmented examinations are specified as required. Additionally, as discussed in the staff evaluation of RAI 3.5.2.2.1.3.3-1, the staff notes that the Fermi 2 operating experience of the torus ring girders and downcomers identified no loss of material due to corrosion; therefore, a plant-specific program is not necessary to manage the aging effect. The staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the enhanced Containment Inservice Inspection – IWE Program is acceptable because the plant-specific operating experience indicates no loss of material due to corrosion of the Fermi 2 torus ring girders and downcomers and because the applicant's approach to managing the aging effect is consistent with the recommendations in GALL Report item II.B1.1.CP-109, which corresponds to LRA Table 3.5.1, item 3.5.1-7.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.5.2.2.1.3, item 3, criteria. For those items associated with LRA Section 3.5.2.2.1.3, item 3, as amended by letter dated January 30, 2015, 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).

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, and elevated temperature in steel prestressing tendons exposed to air-indoor uncontrolled or air-outdoor environments. The criteria in SRP-LR Section 3.5.2.2.1.4 state that the evaluation of this TLAA is addressed separately in SRP-LR Section 4.5. The applicant stated that this item is not applicable because the Fermi 2 containment is a Mark I steel containment and because its design does not contain prestressing tendons. The staff evaluated the applicant's claim and finds it acceptable because the Fermi 2 containment structure is a Mark I steel containment and because prestressing tendons are used only in prestressed concrete containment structures.

Cumulative Fatigue Damage. LRA Section 3.5.2.2.1.5 (as amended by letter dated February 12, 2015, in response to RAI 4.6.1-1 discussed in SER Section 4.6.1), associated with LRA Table 3.5.1, item 3.5.1-9, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA for Fermi 2 containment components, including the torus, vent line bellows, and downcomers, is addressed in LRA Section 4.6, "Containment Liner Plates, Metal Containments, and Penetrations Fatigue Analysis." This is consistent with SRP-LR Section 3.5.2.2.1, item 5, and is, therefore, acceptable. The staff's evaluation of the TLAAs for the Fermi 2 primary containment suppression chamber (torus) and vent system, vent line bellows, refueling and drywell seal bellows, traversing incore probe penetration bellows, containment flued head penetrations, and penetration sleeve bellows is documented in SER Section 4.6.

Cracking Due to Stress Corrosion Cracking. LRA Section 3.5.2.2.1.6, associated with LRA Table 3.5.1, item 3.5.1-10, addresses stainless steel containment 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 acceptance criteria in SRP-LR Section 3.5.2.2.1.6 state that cracking due to SCC of stainless steel penetration bellows and dissimilar metal welds could occur in all types of PWR and BWR containments. The SRP-LR also states that the existing program relies on GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE" and AMP XI.S4, "10 CFR Part 50, Appendix J" to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations implemented to detect cracking due to SCC for these stainless steel containment penetration components.

The applicant credited the existing Containment Inservice Inspection – IWE Program and Containment Leak Rate Program to manage cracking due to SCC, as recommended in the GALL Report. The LRA states that the applicant's Containment Inservice Inspection – IWE Program and Containment Leak Rate Program are consistent with GALL Report AMP XI.S1 and AMP XI.S4, respectively. The applicant also stated that initiation and propagation of SCC require the following three factors: (1) a material susceptible to SCC, (2) a high tensile stress, and (3) a corrosive environment. The applicant further stated that elimination of any of these factors prevents SCC. In addition, the applicant stated that SCC is not expected to occur in the stainless steel penetration components at Fermi 2 because these components are not exposed to a corrosive environment (e.g., environments contaminated with chlorides, fluorides, or sulfates). The applicant stated that its review of plant-specific operating experience did not identify cracking of these components. The applicant also stated that containment pressure boundary functions have not been identified as a concern at Fermi 2.

In its review, the staff finds the applicant's aging management for the stainless steel containment penetration components acceptable because the applicant clarified that (1) the environment without chemical contamination is not conducive to SCC of the component, (2) the plant-specific operating experience indicates the absence of SCC in these components, and (3) the existing Containment Inservice Inspection – IWE Program and Containment Leak Rate Program are used to ensure the integrity of these components.

The staff's evaluations of the applicant's Containment Inservice Inspection – IWE Program and Containment Leak Rate Program are documented in SER Sections 3.0.3.2.5 and 3.0.3.1.8, respectively. In its review of components associated with LRA Table 3.5.1, item 3.5.1-10, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using these programs is acceptable because the applicant's evaluation confirms that (1) the environment without chemical contamination is not conducive to SCC, (2) the plant-specific operating experience does not identify cracking of the components, and (3) the existing Containment Inservice Inspection – IWE Program and Containment Leak Rate Program will continue to ensure that cracking due to SCC does not affect the integrity of the components.

Based on the programs identified, the staff determines that the applicant's programs and aging management evaluation meet the criteria in SRP-LR Section 3.5.2.2.1.6. 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).

Loss of Material (Scaling, Spalling) and Cracking Due to Freeze-Thaw. 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: dome, wall, basemat, ring girders, and/or buttresses exposed to an air-outdoor environment or a groundwater/soil environment. The criteria in SRP-LR Section 3.5.2.2.1.7 state that further evaluation of this aging effect is recommended for plants located in moderate to severe weathering conditions. The SRP-LR also states that a plant-specific program is not required if documented evidence confirms that the existing concrete has an air content of 3 percent to 8 percent and if subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. The applicant stated that this item is not applicable to the Fermi 2 primary containment structure because the concrete base foundation is founded below grade integral with the reactor building base foundation and is not exposed to an air-outdoor environment that is subject to freeze-thaw action and because the GALL Report item is not associated with the Fermi 2 BWR Mark I steel containment structure type. The staff reviewed UFSAR Section 3.8 and confirmed that the Fermi 2 steel containment vessel, concrete floor slab, and reactor vessel pedestal are surrounded by the reactor building and are integral with the reinforced concrete basemat of the reactor building; therefore, these concrete elements are not exposed to the environment required for this aging effect to occur. The staff evaluated the applicant’s claim and finds it acceptable because this aging effect is applicable to concrete containment structures and because Fermi 2 has a Mark I carbon steel containment structure type.

Cracking Due to Expansion and Reaction with Aggregates. 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 a reaction with aggregates in inaccessible areas of concrete elements exposed to any environment. The criteria in SRP-LR Section 3.5.2.2.1.8 state that a plant-specific AMP is not necessary if investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295, “Standard Guide for Petrographic Examination of Aggregates for Concrete,” and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within concrete, or for potentially reactive aggregates, aggregate concrete reaction is not significant if the structure was constructed in accordance with ACI 318, “Building Code Requirements for Reinforced Concrete.” The applicant stated that this item is not applicable because the GALL Report item is not associated with the Fermi 2 Mark I steel containment structure. The LRA also states that materials for the containment vessel concrete base foundation were investigated, tested, and examined in accordance with Michigan Department of State Highways and ASTM standards and that, if potentially reactive aggregates were encountered, low-alkali Portland cement was used to prevent reaction with aggregates. The applicant further stated that based on ongoing industry operating experience, the Structures Monitoring Program will manage this aging effect in accessible concrete areas for the Fermi 2 steel containment vessel concrete base foundation. The staff reviewed UFSAR Section 3.8 and confirmed that the Fermi 2 steel containment vessel concrete base slab and reactor vessel pedestal are surrounded by the reactor building and that they are integral with the reinforced concrete basemat of the reactor building. The staff evaluated the applicant’s claim and finds it acceptable because (1) this aging effect is applicable to concrete containment structures, whereas Fermi 2 has a Mark I carbon steel containment structure type, and (2) the use of the Structures Monitoring Program to manage the aging effect of cracking due to expansion from reaction with aggregates for the basemat foundation of a steel containment is consistent with the GALL Report recommendation.

Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide and Carbonation. 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 increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of concrete elements exposed to a flowing water environment. The criteria in SRP-LR Section 3.5.2.2.1.9 recommend further evaluation if leaching is observed in accessible areas that impact intended functions. The SRP-LR also states that a plant-specific AMP is not required, even if reinforced concrete is exposed to flowing water if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation or (2) an evaluation has 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 stated that this item is not applicable because the GALL Report item is not associated with the Fermi 2 Mark I steel containment structure. The applicant also stated that the steel containment vessel structure's concrete base foundation is below grade, is protected by the reactor building's concrete base foundation, and is not exposed to the flowing water environment necessary for this aging effect to occur. The staff reviewed UFSAR Section 3.8 and confirmed that the Fermi 2 Mark I steel containment vessel concrete components are surrounded by the reactor building and that they are integral with the reinforced concrete basemat of the reactor building; therefore, these concrete elements are not exposed to the environment required for this aging effect to occur. The staff evaluated the applicant's claim and finds it acceptable because this aging effect is applicable to concrete containment structures and because Fermi 2 is a Mark I carbon steel containment structure type.

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 several areas listed below.

Aging Management of Inaccessible Areas.

(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 an air-outdoor environment. The criteria in SRP-LR Section 3.5.2.2.2.1, item 1, state that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur for below-grade inaccessible concrete areas of Groups 1–3, 5, and 7–9 exposed to outdoor air and that the GALL Report recommends further evaluation of the need for a plant-specific AMP for plants located in moderate to severe weathering conditions. As stated in the GALL Report, a plant-specific program is not required if documented evidence confirms that the existing concrete had air content of three percent to eight percent, and if subsequent inspections have not identified degradation related to freeze-thaw. The applicant originally stated that this item is not applicable because (a) the Fermi 2 concrete structures are designed and constructed in accordance with the recommendations in ACI 318-63 and/or ACI 318-71, (b) Fermi 2 specifications provide a durable concrete that is not subject to freeze-thaw aging effects, and (c) Fermi 2 specifications require the use of an air-entraining agent for concrete subject to weathering.

In its review of components associated with LRA Table 3.5.1, item 3.5.1-42, the staff noted that Fermi 2 is located in a severe weathering condition; however, sufficient information had not been provided to adequately address the further evaluation criteria. In its review of LRA Section 3.5.2.2.2.1, item 1, the staff noted that the applicant did not provide documented evidence that confirms that the existing concrete has air content of 3 to 8 percent and did not discuss results of past inspections that demonstrate that freeze-thaw degradation is not an issue. Therefore, by letter dated September 26, 2014, the staff issued RAI 3.5.2.2.2.1-1, requesting that the applicant (a) confirm whether the existing concrete for Groups 1–3, 5, and 7–9 structures had air content between 3 percent and 8 percent, (b) describe whether the results of past inspections have identified degradation attributed to freeze-thaw, and (c) if evidence is unavailable, demonstrate air content between 3 percent and 8 percent, to provide either a description of a plant-specific AMP to manage the aging effects or a technical basis for not proposing a plant-specific program.

In its response dated October 24, 2014, the applicant stated that the air content values for below-grade inaccessible concrete of Groups 1–3, 5, and 7–9 structures are less than 3 percent based on the review of test results and are consistent with the original site-specific design and are between 3 percent and 8 percent for the above-grade concrete. The applicant also stated that past inspections of the Fermi 2 structures under the Structures Monitoring Program and from projects where below-grade exterior concrete walls were exposed did not identify degradation attributed to freeze-thaw. The applicant revised LRA Section 3.5.2.2.2.1, item 1, and LRA Table 3.5.1, item 3.5.1-42, to clarify that the Structures Monitoring Program will manage the loss of material and cracking due to freeze-thaw in below-grade inaccessible concrete of Groups 1–3, 5, and 7–9 structures through visual inspections when they become accessible as a result of an excavation activity and when observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible area.

The staff finds the applicant’s response acceptable because the applicant stated that the Structures Monitoring Program will manage the aging effects loss of material and cracking due to freeze-thaw in inaccessible areas of Groups 1–3, 5, and 7–9 structures after clarifying that air content for concrete in inaccessible areas of these groups of structures is less than 3 percent and that no degradation has been attributed to freeze-thaw from past inspections. The staff’s concern described in RAI 3.5.2.2.2.1-1 is resolved.

The staff’s evaluation of the applicant’s Structures Monitoring Program is documented in SER Section 3.0.3.2.22. The staff noted that the Structures Monitoring Program proposes to manage the effects of aging for below-grade inaccessible concrete areas of these groups of structures through the use of visual inspections when they become accessible as a result of an excavation activity and when observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible area. The staff also noted that, consistent with the GALL Report recommendation, LRA Table 3.5.1, item 3.5.1-64, manages loss of material and cracking due to freeze-thaw in exterior and below-grade accessible areas and foundations of Groups 1–5 and 7–9 concrete structures using the Structures Monitoring Program. The staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the Structures Monitoring Program is acceptable because (1) the program is consistent with the AMP recommended by the GALL Report for managing these aging effects in accessible areas for these groups of structures, (2) management of these aging effects through visual inspection of inaccessible concrete areas when they become accessible for any reason and through use of the observed condition from accessible areas as an indicator is consistent with the GALL Report recommendation to adequately manage concrete degradations due to freeze-thaw before there is a loss of intended function, and (3) past inspections from exposed inaccessible areas have not revealed concrete structural degradations attributed to freeze-thaw.

Based on the program identified, the staff determines that the applicant’s program meets SRP-LR Section 3.5.2.2.2.1, item 1, criteria. For those items associated with LRA

Section 3.5.2.2.2.1, 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).

(2) LRA Section 3.5.2.2.2.1, item 2, associated with LRA Table 3.5.1, item 3.5.1-43, addresses concrete in below-grade inaccessible concrete areas of Groups 1–5 and 7–9 structures exposed to soil, which will be managed for cracking due to expansion from reaction with aggregates by the Structures Monitoring Program. The criteria in SRP-LR Section 3.5.2.2.2.1, item 2, state that cracking due to expansion from reaction with aggregates could occur for inaccessible concrete areas of Groups 1–5 and 7–9 structures exposed to any environment. The SRP-LR also states that, if concrete was not constructed in accordance with the recommendations in the GALL Report, further evaluation is recommended to determine whether a plant-specific AMP is necessary to manage this aging effect. As stated in the GALL Report, a plant-specific AMP is not necessary if (1) investigations, tests, and petrographic examination of aggregates performed in accordance with ASTM C295 and other ASTM reactivity tests can demonstrate that those aggregates do not adversely react within concrete or (2) the applicant can demonstrate that, for potentially reactive aggregates, the in-place concrete can perform its intended function. The applicant addressed the further evaluation criteria of the SRP-LR by stating that (1) Fermi 2 Groups 1–5 and 7–9 concrete structures are designed and constructed in accordance with the recommendations in ACI 318-63 and/or ACI 318-71, (2) the aggregate used did not come from a region known to yield aggregates suspected of, or known to cause, aggregate reactions, and (3) materials were specifically investigated, tested, and examined in accordance with pertinent Michigan Department of State Highways and ASTM standards. However, the applicant also stated that the Structures Monitoring Program manages this aging effect by considering ongoing industry operating experience.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.22. The staff noted that the Structures Monitoring Program proposes to manage the effects of aging for below-grade inaccessible concrete areas of these groups of structures through the use of visual inspections when they become accessible as a result of an excavation activity and when observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible area. The staff also noted that, consistent with the GALL Report recommendation, LRA Table 3.5.1, item 3.5.1-54, manages cracking due to expansion from reaction with aggregates in all accessible concrete areas of Groups 1–5 and 7–9 structures using the Structures Monitoring Program. The staff reviewed UFSAR Section 3.8.4.6.1 and confirmed that Fermi 2 concrete structures are designed and constructed in accordance with the recommendations in ACI 318 and ACI 349. Based on its review of components associated with LRA Table 3.5.1, item 3.5.1-43, for which the applicant cited generic note E, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the Structures Monitoring Program is acceptable because (1) the program is consistent with the AMP recommended by the GALL Report for managing this aging effect in accessible areas for these groups of structures, (2) management of this aging effect through visual inspection of inaccessible concrete areas when they become accessible for any reason and through use of the observed condition from accessible areas as an indicator is consistent with the GALL Report recommendations to adequately identify concrete degradation due to expansion and reaction with aggregates before there is a loss of intended function, and (3) Fermi 2 concrete structures are designed and constructed in accordance with the recommendations in ACI 318 and ACI 349, and (4) past inspections from exposed inaccessible areas have not revealed concrete structural degradations attributed to expansion due to reaction with aggregates.

Based on the program identified, the staff determines that the applicant's program meets 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, 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) LRA Section 3.5.2.2.2.1, item 3, associated with LRA Table 3.5.1, item 3.5.1-44, addresses inaccessible concrete areas of structures for all groups exposed to soil, which will be managed for cracks and distortion due to increased stress levels from settlement by the Structures Monitoring Program. The criteria in SRP-LR Section 3.5.2.2.2.1, item 3, state that cracking and distortion due to increased stress levels from settlement could occur in below-grade inaccessible concrete areas for all groups of structures. The SRP-LR further states that the existing program relies on structure monitoring programs to manage these aging effects but that some plants may rely on a dewatering system to control settlement or erosion. The SRP-LR also states that the GALL Report recommends the verification of the continued functionality of the dewatering system through the period of extended operation for plants that credit a dewatering system in their CLB. The applicant addressed the further evaluation criteria of the SRP-LR by stating that Fermi 2 structures do not rely on a dewatering system to control settlement.

The applicant stated that for LRA Table 3.5.1, item 3.5.1-44, the applicability is limited to the process facilities and yard structures exposed to compacted structural backfill or soil environment because other structures are founded on bedrock and because the aging effects of cracking and distortion due to increased stress levels from settlement are not applicable. The staff reviewed UFSAR Section 3.8.5 and confirmed that Fermi 2 Category 1 structures are founded on bedrock; however, sufficient information was not provided to confirm whether the turbine building foundation is susceptible to cracking and distortion due to increased stress levels from settlement. Therefore, by letter dated December 23, 2014, the staff issued RAI 3.5.2.2.2.1-2, requesting that the applicant describe the foundation type for Fermi 2 turbine building and, if the structure is not founded on bedrock and is susceptible to these aging effects, state how these aging effects will be adequately managed for the period of extended operation or provide additional information to justify why these aging effects do not require aging management.

In its response dated January 26, 2015, the applicant stated that the Fermi 2 turbine building has a mat founded on bedrock, as confirmed by site drawings and calculations, and that the aging effects of cracking and distortion due to increased stress levels from settlement are not applicable to the turbine building. The applicant also stated that the turbine pedestal is founded on bedrock.

The staff noted that the applicant's response and general search of the applicant's UFSAR confirmed that there are no in-scope concrete structures exposed to soil environment and susceptible to increased stress levels from settlement, except those listed in LRA Section 3.5.2.2.2.1, item 3, and LRA Table 3.5.1, item 3.5.1-44. The staff finds the applicant's response acceptable because the applicant clarified that the turbine building is founded on bedrock, as confirmed by site drawings and calculations;

therefore, the aging effects of cracking and distortion due to increased stress levels from settlement are not credible aging effects for the turbine building. The staff's concern described in RAI 3.5.2.2.2.1-2 is resolved.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.22. The staff noted that the Structures Monitoring Program will be used to manage cracking and distortion of concrete in accessible and inaccessible concrete areas for structures founded on soil through visual inspections of structures at a frequency of 5 years, with provisions for more frequent inspection to ensure that there is no loss of intended function between inspections. The staff also noted that a review of the applicant's CLB documents concluded that no dewatering system was credited to lower the groundwater level or to control settlement at the site. The staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the Structures Monitoring Program is acceptable because (1) the program is consistent with the AMP recommended by the GALL Report for managing this aging effect in accessible areas for these groups of structures, (2) the in-scope Fermi 2 Category I concrete structures and turbine building are founded on bedrock, and (3) Fermi 2 does not rely on a dewatering system to lower the groundwater level or to control settlement at the site.

LRA Section 3.5.2.2.2.1, item 3, associated with LRA Table 3.5.1, items 3.5.1-45 and 3.5.1-46, addresses reduction in foundation strength, cracking due to differential settlement, and erosion of porous concrete subfoundations in inaccessible concrete areas of Groups 1–3 and 5–9 structures exposed to a fluid environment. The criteria in SRP-LR Section 3.5.2.2.2.1, item 3, state that reduction in foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1–3 and 5–9 structures. The SRP-LR further states that the existing program relies on structure monitoring programs to manage these aging effects but that some plants may rely on a dewatering system to control settlement or erosion. The SRP-LR also states that the GALL Report recommends the verification of the continued functionality of the dewatering system through the period of extended operation for plants that credit a dewatering system in their CLB. The applicant stated that this item is not applicable because Fermi 2 Groups 1–3 and 5–9 concrete structures do not use porous concrete subfoundations, do not have water flowing underneath the foundation, and do not rely on a dewatering system for control of settlement. The staff's review of applicant's CLB documents concluded that no dewatering system was credited to lower the groundwater level or control settlement at the site. The staff evaluated the applicant's claim and finds it acceptable based on its review of UFSAR Section 2.5, which confirmed that the Fermi 2 concrete structures are not founded on porous concrete subfoundations but are generally founded on grouted bedrock or on compacted crushed rock fill or soil and that Fermi 2 does not rely on a dewatering system to lower the groundwater level or control settlement at the site.

Based on the program identified, the staff determines that the applicant's program meets 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, item 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).

(4) LRA Section 3.5.2.2.2.1, item 4, associated with LRA Table 3.5.1, item 3.5.1-47, addresses increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in below-grade inaccessible concrete areas of Groups 1–5 and 7–9 structures exposed to flowing water. The criteria in SRP-LR Section 3.5.2.2.2.1, item 4, state 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 these structures. The SRP-LR also states that the GALL Report recommends further evaluation if leaching is observed in accessible areas that impact the intended functions of the concrete structure. As stated in the GALL Report, a plant-specific AMP is not required for the reinforced concrete exposed to flowing water if (1) there is evidence in the accessible areas that the flowing water has not caused leaching of calcium hydroxide and carbonation or (2) an evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure.

During its review of components associated with LRA Table 3.5.1, item number 3.5.1-47, the staff noted that the applicant stated that these groups of structures are not subject to the flowing water environment necessary for these aging effects to occur and that no leaching has been observed in accessible areas of Fermi 2 concrete structures; however, during the AMP audit, the staff observed indications of concrete leaching in the floor and walls of the turbine building basement and identified operating experience associated with groundwater in leakage and leaching issues in the reactor building, RHR complex, and manholes. Therefore, by letter dated December 23, 2014, the staff issued RAI 3.5.2.2.2.1-3, requesting that the applicant (1) provide a summary of operating experience regarding leaching of calcium hydroxide and carbonation in accessible areas of these group of structures, (2) state whether it has performed an evaluation to determine the impact on the intended function of the concrete structure, (3) describe the results, and (4) if it has not performed an evaluation, state and describe how this aging effect will be adequately managed for inaccessible areas.

In its response dated January 26, 2015, the applicant provided plant operating experience of seven water in-leakage events that may appear to be potential leaching of calcium hydroxide and carbonation in accessible areas. The applicant stated that these events have generally been characterized as efflorescence. In addition, to confirm that these deposits are not the results of leaching of calcium hydroxide and carbonation that could impact the intended functions of the concrete structures, the applicant revised the LRA to include Commitment No. 34n, to perform testing (for mineral and iron content) and evaluation of previously identified conditions before the period of extended operation to confirm that the observed conditions are not the result of leaching of calcium hydroxide and carbonation. The applicant also stated that it will perform similar testing on samples for future observations of the same nature to determine whether the observed condition in accessible areas is experiencing leaching of calcium hydroxide and carbonation and, based on the test results, will perform further evaluations to determine whether the observed condition has any impact on the intended functions of the concrete element (Commitment No. 34m). The applicant further stated that it will develop a similar corrective action plan for testing and evaluation of concrete elements in inaccessible concrete areas if observed conditions in accessible areas are found to impact the intended functions of the concrete elements in question. An enhancement (Commitment Nos. 34m and 34n) to the LRA Structures Monitoring Program and a revision to LRA Section B.1.42 were provided to manage the potential for these aging effects.

Based on its review, the staff finds the applicant's general characterization as efflorescence for the conditions identified in the plant's operating experience to be inconsistent with the staff's observations from the operating experience reviewed during the AMP audit. As noted in the "Aging Management Programs Audit Report Regarding the Fermi 2 Nuclear Power Plant (TAC No. MF4222)" (ADAMS Accession No. ML15030A229), CARD 10-22385, CARD 12-27792, and CARD 09-26756 identified the presence of leaching in the RHR complex, auxiliary building basement, and reactor building subbasement. The applicant described the condition as leaching due to groundwater in-leakage and concluded that the identified conditions do not affect the structural integrity of the structures. To clarify the inconsistency between the staff's observation and the applicant's response, the staff reviewed the CARDs referenced in the applicant's response during its onsite inspection of the applicant's license renewal activities. The staff confirmed that several of the identified conditions by the applicant are associated with leaching, consistent with the staff's observations made during the AMP audit. The staff notes that the applicant will perform further testing and evaluation for these identified conditions before the period of extended operation to confirm that existing conditions are not the result of leaching of calcium and carbonation that could impact the intended function(s) of the concrete structures (Commitment No. 34n).

The staff also notes that the applicant's response includes an enhancement to the Structures Monitoring Program (Commitment No. 34m) to manage the potential aging effect of increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation for accessible areas based on testing and evaluation of observed conditions of in-leakage (water and mineral deposits). The staff finds that the use of this same enhancement to detect degradation for concrete elements in inaccessible areas based on observed conditions in accessible areas allows the applicant to manage the potential for these aging effects before a loss of intended function. However, during the staff's review of components associated with LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, the staff noted that this enhancement appears to be inconsistent or in conflict with LRA Table 3.5.1 AMR items because they continue to be identified as "not applicable." Therefore, by letter dated April 22, 2015, the staff issued followup RAI 3.5.2.2.2.1-3a, requesting that the applicant clarify and/or reconcile the inconsistencies between LRA Commitment Nos. 34m and 34n, and the nonapplicability of LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, and provide the Table 2 AMR items for the structures and components associated with this aging effect. Otherwise, the staff requested that the applicant provide its technical basis to justify why LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, continue to remain "not applicable."

In its response dated May 19, 2015, the applicant stated that the aging effects of increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation are applicable to Groups 1–5 and 7–9 concrete structures. The applicant revised LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, to indicate that the aging effects are applicable and will be managed by the Structures Monitoring Program. The applicant also revised LRA Section 3.5.2.2.2.1, item 4, and LRA Tables 3.5.2-1 and 3.5.2-3 for consistency.

The staff finds the applicant's response acceptable because the applicant clarified that these aging effects associated with LRA Table 3.5.1, items 3.5.1-47 and 3.5.1-63, are applicable and will be managed by the Structures Monitoring Program for Groups 1–5 and 7–9 concrete structures and provided revisions to the LRA to indicate its applicability consistent with the GALL Report recommendation. The staff's concern described in followup RAI 3.5.2.2.2.1-3a is resolved.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.22. The staff noted that the Structures Monitoring Program is enhanced to include testing and evaluation of water/mineral deposits where in-leakage is observed in concrete elements and to determine whether leaching of calcium hydroxide and carbonation are occurring that could impact the intended function of the concrete structures. The staff also notes that the Structures Monitoring Program proposes to manage these aging effects in inaccessible concrete areas when observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible area. The staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the Structures Monitoring Program is acceptable because (1) it will ensure that these aging effects are adequately managed before loss of intended function and (2) the proposed program for the inaccessible area is consistent with the AMP recommended by the GALL Report for the same aging effects and mechanisms for accessible areas.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.2.1, item 4, criteria. For those items associated with LRA Section 3.5.2.2.2.1.4, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus Due to Elevated Temperature. LRA Section 3.5.2.2.2.2, associated with LRA Table 3.5.1, item 3.5.1-48, addresses Groups 1–5 concrete structures exposed to an air-indoor uncontrolled environment which will be managed for reduction of strength and modulus due to elevated temperature by the Structures Monitoring Program. The criteria in SRP-LR Section 3.5.2.2.2.2 recommend further evaluations for any concrete elements that exceed specified temperature limits. The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits (i.e., a general area temperature greater than 150 °F and a local area temperature greater than 200 °F). However, higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and if these reductions are applied to the design calculations. The applicant addressed the further evaluation criteria of the SRP-LR by stating that Fermi 2 Groups 1–5 concrete structures are not exposed to temperatures exceeding the limits described in the GALL Report, except for the main steam tunnel (pipe tunnel) in the turbine building.

The applicant stated that for LRA Table 3.5.1, item 3.5.1-48, the applicability is limited to the concrete of the main steam tunnel (pipe tunnel) in the turbine building exposed to an air-indoor uncontrolled environment. The staff reviewed UFSAR Section 9.4 and confirmed that Fermi 2 ventilation systems are designed to maintain the general area temperature of structures below 150 °F during normal operation with an exception for the turbine building steam tunnel area. The staff also noted that UFSAR Section 3.8.2.1.3.1 provides design consideration to limit the concrete local area temperatures to less than 150 °F for a pipe sleeve penetration adjacent to concrete and to limit the fluid temperatures in pipelines to less than 150 °F when an unsleeved penetration is use. The staff's review confirmed that no in-scope concrete exposed to an air-indoor uncontrolled environment is present in the structures except for the main steam tunnel (pipe tunnel) in the turbine building, as specified in LRA Section 3.5.2.2.2.2.

In its review of components associated with LRA Table 3.5.1, item 3.5.1-48, the staff noted that sufficient information had not been provided to adequately address the further evaluation criteria and to determine whether the Structures Monitoring Program would adequately manage the aging effect of "changes in material properties" due to elevated temperatures at the turbine building main steam tunnel. Therefore, by letter dated November 25, 2014, the staff issued RAI 3.5.2.2.2.2-1, requesting that the applicant clarify whether a reduction in strength and modulus of elasticity was applied in the design calculations of Fermi 2 Group 1–5 concrete structures exposed to local and/or general area temperatures above the limits specified in the GALL Report and, if it was not applied in the design calculations, explain how the Structures Monitoring Program will adequately manage this aging effect.

In its response dated December 26, 2014, the applicant stated that a reduction in strength and modulus of elasticity was not applied in the design calculations of Fermi 2 Group 1–5 concrete structures exposed to general area temperatures above 150 °F or local area temperatures above 200 °F. The applicant further stated that that the Structures Monitoring Program will adequately manage the aging effects of reduction of strength and modulus of elasticity due to elevated temperature by addressing the aging effects of loss of material, cracking, and change in material properties and by monitoring parameters to manage this aging effects on exposed concrete surfaces. The acceptance criteria include the absence of spalling, cracking, and other physical damages consistent with the parameters identified in ACI 349.3R-02, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," dated January 1, 2002, for concrete degradations due to external exposure. The applicant revised LRA Table 3.5.1, item 3.5.1-48, to reflect these changes.

In its review of the applicant's response, the staff determined that additional information was needed to evaluate the adequacy of the applicant's plant-specific activities to manage the aging effects of "reduction of concrete strength and modulus due to elevated temperature" for the main steam pipe tunnel concrete in the turbine building because of the following concerns:

- It was not clear how the applicant's Structures Monitoring Program will be capable of detecting the presence and extent of the aging effects of reduction in concrete strength and modulus of elasticity (change in material properties) due to long-term exposure to elevated temperatures by visual inspection of the condition of the exposed concrete surface (parameters monitored) because there may be no visible physical manifestation (e.g., spalling, scaling, and cracking) indicative of reduction of concrete strength and modulus of elasticity under prolonged exposure to elevated temperatures below 300 °F (EPRI TR-103842 and SRP-LR Section 3.5.2.2.2.2).
- The Structures Monitoring Program described in LRA Sections A.1.42 and B.1.42 and audited by the staff did not appear to address the plant-specific program aspect related to the "reduction in concrete strength and modulus due to elevated temperature" aging effect for which visible symptoms are not likely to manifest at temperatures below 300 °F.
- The LRA component intended functions for the concrete main steam pipe tunnel appeared to indicate that the structure supports equipment loads. The applicant claimed consistency with the GALL Report, but the response to RAI 3.5.2.2.2.2-1 did not address the GALL Report, item III.A3.TP-114, recommendation that if significant equipment loads are supported by the concrete at temperatures exceeding 150 °F, an evaluation of its ability to withstand the postulated design loads must be made.

Therefore, by letter dated April 22, 2015, the staff issued followup RAI 3.5.2.2.2.2-1a, requesting that the applicant provide information with a technical basis to address the following activities:

- Demonstrate the adequacy of the parameters proposed to be monitored or inspected by the plant-specific aspect of the Structures Monitoring Program to detect, quantify extent, and manage the aging effects of "reduction of concrete strength and modulus due to elevated temperature" of the main steam pipe tunnel concrete.
- Clearly establish the link between the parameters proposed to be monitored and explain how monitoring these parameters will ensure adequate aging management of the "reduction of concrete strength and modulus due to elevated temperature" before loss of intended functions of the main steam pipe tunnel concrete such that CLB design conditions will be maintained during the period of extended operation.
- Address the GALL Report, item III.A3.TP-114, recommendation that if significant equipment loads are supported by the concrete at temperatures exceeding 150 °F, an evaluation of its ability to withstand the postulated design loads must be made.
- Ensure consistency of applicable LRA program elements, UFSAR supplement, and/or AMR tables, as appropriate, with the response to the requests above.

In its response dated May 19, 2015, the applicant stated that Fermi 2 had conservatively assumed the turbine building steam tunnel concrete temperature to be above the temperature criteria of the GALL Report. The applicant also stated that a review of temperature data from a recent cycle during normal operation confirmed that sustained bulk air temperatures in the turbine building steam tunnel are below the GALL Report threshold. The applicant further stated that local area temperature of the concrete is not above the 200 °F threshold from the ACI 349 recommended provision. Therefore, the applicant stated that reduction in strength and modulus for accessible and inaccessible concrete is not an AERM. As a result, the applicant revised LRA Sections 3.5.2.1.3 and 3.5.2.2.2.2 and LRA Table 3.5.1, item 48, and LRA Table 3.5.2-3 to indicate that the aging effect is not applicable to the turbine building steam tunnel concrete.

Considering the applicant's responses to followup RAI 3.5.2.2.2.2-1a, the staff notes that the concrete elements are not exposed to the environment necessary for this aging effect to occur and that further evaluation is not required to be addressed, as recommended by the GALL Report. The staff finds the applicant's response acceptable because the technical justification provided clarifies that sustained air temperatures for local and general areas in the turbine building steam tunnel are below the GALL Report threshold. The staff's concern described in followup RAI 3.5.2.2.2.2-1a is resolved.

<u>Aging Management of Inaccessible Areas for Group 6 Structures</u>.

(1) LRA Section 3.5.2.2.2.3, item 1, associated with LRA Table 3.5.1, item 3.5.1-49, addresses below-grade inaccessible concrete areas of Group 6 structures exposed to an air-outdoor environment, which will be managed for loss of material (spalling, scaling) and cracking due to freeze-thaw by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. The criteria in SRP-LR Section 3.5.2.2.2.3, item 1, state that further evaluation of this aging effect is recommended for inaccessible areas of this group of structures 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 content of 3 percent to 8 percent and if subsequent inspection did not exhibit degradation related to freeze-thaw. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade (above the frost line) concrete for Fermi 2 Group 6 concrete structures. As stated in the applicant's response to RAI 3.5.2.2.2.1-1, dated October 24, 2014, documented in SER Section 3.5.2.2.2, the applicant will perform visual inspections of inaccessible areas when they become accessible as a result of an excavation activity and when observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible area.

The staff's evaluation of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.20. The staff noted that the applicant implemented the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as part of the Structures Monitoring Program. The staff also noted that, consistent with the GALL Report recommendation, LRA Table 3.5.1, item 3.5.1-60, manages loss of material (spalling, scaling) and cracking due to freeze-thaw in accessible concrete areas of Group 6 structures using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. In its review of components associated with LRA Table 3.5.1, item 3.5.1-49, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is acceptable because (1) the program is consistent with the AMP recommended by the GALL Report for managing this aging effect in accessible areas for this group of structures, (2) management of this aging effect through visual inspection of inaccessible areas, when they become accessible for any reason, and through use of the observed condition from accessible areas as an indicator is consistent with the GALL Report recommendation to adequately manage concrete degradation due to freeze-thaw before there is a loss of intended function, and (3) past inspections from exposed inaccessible areas have not revealed concrete structural degradation attributed to freeze-thaw.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.2.3, item 1, criteria. For those items associated with LRA Section 3.5.2.2.2.3.1, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.5.2.2.2.3, item 2, associated with LRA Table 3.5.1, item 3.5.1-50, addresses inaccessible concrete of Group 6 structures exposed to air-outdoor, air-indoor uncontrolled, soil, and fluid environments, which will be managed for cracking due to expansion from reaction with aggregates by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. The criteria in SRP-LR Section 3.5.2.2.2.3, item 2, state that cracking due to expansion from reaction with aggregates could occur in below-grade inaccessible concrete areas of Group 6 structures exposed to any environment. The GALL Report recommends further evaluation to determine whether a plant-specific program is required to manage the aging effect. The SRP-LR also states that a plant-specific program is not required if (1) investigations, tests, and petrographic examinations of aggregates performed in

accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within reinforced concrete or (2) for potentially reactive aggregates, aggregate reinforced concrete reaction is not significant if the structure was constructed in accordance with ACI 318. The applicant addressed the further evaluation criteria of the SRP-LR by stating that Fermi 2 Group 6 concrete structures are designed and constructed in accordance with the recommendations of ACI 318-63 and/or ACI 318-71; however, based on ongoing industry operating experience, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages this aging effect for below-grade inaccessible concrete areas.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.20. The staff noted that the applicant implemented the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as part of the Structures Monitoring Program. The staff also noted that the use of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program through the Structures Monitoring Program to manage this aging effect is consistent with the recommendations of the GALL Report to manage the same structures/aging effect combinations in accessible areas. The staff reviewed UFSAR Section 3.8.4.6.1 and confirmed that Fermi 2 concrete structures are designed and constructed in accordance with the recommendations in ACI 318. Based on its review of components associated with item 3.5.1-50 for which the applicant cited generic note E, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is acceptable because (1) the program is consistent with the AMP recommended by the GALL Report for managing this aging effect in accessible areas for similar groups of structures, (2) these structures are designed and constructed in accordance with the recommendations in ACI 318, and (3) past inspections from exposed inaccessible areas have not revealed concrete structural degradation attributed to expansion and reaction with aggregates.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.2.1, item 2, criteria. For those items associated with LRA Section 3.5.2.2.2.1.2, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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) 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 Group 6 structures exposed to a fluid environment, which will be managed for increase in porosity and permeability and loss of strength by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. The criteria in SRP-LR Section 3.5.2.2.2.3, item 3, state that increase in porosity and permeability due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible concrete areas of Group 6 structures exposed to a water flowing environment. The GALL Report recommends further evaluation to determine whether a plant-specific program is required to manage the aging effect. The GALL Report also states that a plant-specific AMP is not required if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation or (2) 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 the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages this aging effect for below-grade inaccessible concrete areas.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.20. The staff noted that the applicant implements the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as part of the Structures Monitoring Program. The staff also noted that, consistent with the GALL Report recommendation, LRA Table 3.5.1, item 3.5.1-61, manages increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in accessible concrete areas of Groups 6 structures using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. In its review of components associated with item 3.5.1-51, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is acceptable because (1) this program is consistent with the AMP recommended by the GALL Report for managing this aging effect in accessible areas for this group of structures and (2) management of this aging effect through (1) visual inspection of inaccessible areas when they become accessible for any reason, (2) use of the observed condition, and (3) employment of further testing and evaluation of water/mineral deposits from accessible areas as an indicator is consistent with the GALL Report recommendation to adequately manage concrete degradation due to leaching and carbonation before there is a loss of intended function.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.2.3, item 3, criteria. For those items associated with LRA Section 3.5.2.2.2.3.3, the staff concludes that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion. LRA Section 3.5.2.2.2.4, associated with LRA Table 3.5.1, item 3.5.1-52, addresses cracking due to SCC and loss of material due to pitting and crevice corrosion in stainless steel liners of other components, such as drywell sump, reactor building sump, and turbine building sump, exposed to a fluid environment. The criteria in SRP-LR Section 3.5.2.2.2.4 state that "cracking due to SCC and loss of material due to pitting and crevice corrosion could occur for Group 7 and Group 8 stainless steel tank liners exposed to standing water." The SRP-LR also states that the GALL Report recommends further evaluation of plant-specific programs to manage these aging effects for stainless steel tank liners exposed to standing water. The applicant addressed the further evaluation criteria of the SRP-LR by stating that a plant-specific program is not necessary because, for Fermi 2, there are no (Group 7 or Group 8) concrete or steel tanks with stainless steel liners included as structures within the scope of license renewal; however, the corresponding GALL Report item(s) (e.g., item III.A7.T-23) for concrete tanks can be compared to the stainless steel liners of other components, such as sumps in the containment drywell, reactor building, and turbine building. These liners can be exposed to a fluid environment and may be subjected to loss of material (due to corrosion). The applicant also stated that fluid temperatures are below the threshold value of 140 °F (60 °C) for SCC. The applicant further stated that the Structures Monitoring Program manages the loss of material aging effect for these liners by periodic inspections.

The staff notes that fluid temperatures, to which the sump liners are exposed, are below the threshold value of 140 °F (60 °C), as indicated in GALL Report Section IX.D for SCC; therefore, cracking due to SCC is not an applicable aging effect for these sump liners. For the AMR results items in LRA Tables 3.5.2-1 and 3.5.2-3 that cite generic note E, the LRA credits the Structures Monitoring Program to manage loss of material for the stainless steel liners of drywell sump, reactor building sump, and turbine building sump. The GALL Report recommends the evaluation of a plant-specific program to ensure that these aging effects are adequately managed; however, the staff notes that the applicant does not have any tanks with stainless steel liners included as structures within the scope of license renewal. However, the applicant compared the stainless steel liners of other components (drywell sump, reactor building sump and turbine building sump) to LRA Table 3.5.1, item 3.5.1-52, and proposed to manage loss of material due to corrosion using the Structures Monitoring Program.

The staff's evaluation of the applicant's Structures Monitoring Program, which, with enhancements, is consistent with GALL Report AMP XI.S6, is documented in SER Section 3.0.3.2.22. The staff noted that the program includes monitoring for loss of material due to corrosion for steel structures and components through the use of visual inspections by qualified personnel at a frequency not to exceed 5 years. The staff also noted that the program contains provisions for increased inspection frequency and trending to ensure that there is no loss of intended function between inspections. The staff also noted that the applicant cited generic note E in the Table 2's for components associated with LRA Table 3.5.1, item 3.5.1-52, because the GALL Report recommends further evaluation to determine whether a plant-specific program is needed to manage the aging effects. In its review of components associated with LRA Table 3.5.1, item 3.5.1-52, that cite general note E, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the Structures Monitoring Program is acceptable because (a) the enhanced program will effectively manage loss of material due to corrosion by performing periodic visual inspections of the stainless steel sump liners by qualified personnel at intervals not to exceed 5 years and (b) a plant-specific program is unnecessary.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.4 criteria. For those items associated with LRA Section 3.5.2.2.4, 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cumulative Fatigue Damage Due to Fatigue. LRA Section 3.5.2.2.2.5 states that TLAAs are evaluated in accordance with 10 CFR54.21(c), as documented in LRA Section 4. For LRA Table 3.5.1, item 3.5.1-53, the applicant stated that the AMR item is not applicable because there are no fatigue analyses identified for component support members, welds, or support anchorage to building structures for Groups B1.1, B1.2, and B1.3. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results that are applicable for this item.

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 for 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 not consistent with, or 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 component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.5.2.3.1 Reactor/Auxiliary Building and Primary Containment – 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/auxiliary building and primary containment component groups.

<u>Coating Exposed to Fluid Environment</u>. In LRA Table 3.5.2-1, the applicant stated that Service Level I coatings exposed to a fluid environment will be managed for loss of coating integrity by the Protective Coating Monitoring and Maintenance 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 the credible aging effects for this component, material, and environment description. Based on its review of GALL Report AMP XI.S8 and ASTM D5163-08, "Standard Guide for Establishing a Program for Condition Assessment of Coating Service Level I Coating Systems in Nuclear Power Plants," dated December 2008, which indicate that immersion coatings may be susceptible to failure or loss of coating integrity due to formation of blisters or nodules, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Protective Coating Monitoring and Maintenance Program is documented in SER Section 3.0.3.2.17. The staff finds the applicant's proposal to manage loss of coating integrity using the Protective Coating Monitoring and Maintenance Program acceptable because the AMP provides an effective method to asses coating condition through visual inspections by identifying degraded or damaged coatings and by providing a means for repair of identified problem areas.

On the basis of its review, the staff concludes that for items in LRA Table 3.5.2-1 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Water-Control Structures – Summary of Aging Management Evaluation – LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, as amended by letter dated December 26, 2014, which summarizes the results of AMR evaluations for the water-control structures component groups.

Asbestos Cement Board from RHR Cooling Tower Fill/Mist Eliminators Exposed to a Fluid Environment. In LRA Table 3.5.2-2, as amended by letter dated December 26, 2014, the applicant stated that asbestos cement board, which is used as the RHR cooling tower fill/mist eliminators, is exposed to a fluid environment and will be managed for loss of material by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program. The AMR item cites generic note J.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. However, sufficient information had not been provided to adequately determine which type of fluid environment the asbestos cement board is exposed to in order to consider whether the applicant identified all the credible aging effects for this component. The LRA environment description for “exposed to fluid environment” corresponds to a broad list of environment types that includes environments with raw water, treated water, and/or chemically treated water, which could make cementitious material susceptible to different aging effects. Therefore, by letter dated November 25, 2014, the staff issued RAI 3.5.2.3.2-1, requesting that the applicant clarify the fluid environment to which the asbestos cement board is exposed to, including the water chemistry, and explain why other aging effects relevant to cementitious materials are not considered as credible aging effects.

In its response dated December 26, 2014, the applicant stated that the fluid environment in which the asbestos cement boards are exposed is raw water from Lake Erie. The raw water is chemically treated for control of microbes, corrosion, and deposits, and its chemistry is monitored and maintained within the specified chemical control parameters. The applicant also stated that, although in some cases the water chemistry values are above the ranges of the original Lake Erie water, values described in the water quality study performed at Fermi 2 between 2008 and 2009, as described in Table 2, “Summary of Surface Water Quality Data Collected at Sampling Location LE1-W,” in the report entitled, “Water Quality Survey, Detroit Edison Company, Fermi 3 Project, Final Report,” dated October 2009 (ADAMS Accession No. ML093380411), the chlorides and sulfate values are well below the threshold for an aggressive chemical attack discussed in the GALL Report. The applicant further stated that credible aging effects for the asbestos cement boards do include loss of material due to abrasion and cracking due to freeze-thaw. The applicant clarified that other aging effects, like cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel or due to expansion from reaction with aggregates, are not applicable because the asbestos cement board does not have embedded steel and does not have aggregates that could potentially expand. The applicant revised the LRA to include the additional aging effects of cracking, increase in porosity and permeability, and loss of strength for the asbestos cement board in the RHR cooling tower fill/mist eliminator. The applicant made this revision to be consistent with the application of aging effects to concrete components and to consider that loss of material is already included in LRA Table 3.5.2-2, as amended by letter dated December 26, 2014, as an applicable aging effect.

The staff finds the applicant's response acceptable because it clarifies the fluid environment to which the asbestos cement board is exposed and enhances the AMP to manage additional aging effects for cracking, increase in porosity and permeability, and loss of strength for the asbestos cement board to ensure that there is no loss of intended function between inspections. Based on a review of the GALL Report recommendations, the staff finds that the applicant identified all credible aging effects for a cementitious material exposed to a chemically treated raw water environment. The staff noted that the applicant's consideration of the asbestos cement boards as a concrete component is consistent with the description of asbestos cement in GALL Report Table IX.C as a cementitious material having cementing properties similar to concrete. The staff's concern described in RAI 3.5.2.3.2-1 is resolved.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is documented in SER Section 3.0.3.2.20. The staff noted that the applicant implements the planned to be enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program as part of the Structures Monitoring Program and includes monitoring for loss of material, loss of bond, increase in porosity and permeability, and loss of strength on concrete structures and components associated with water-control structures with inspection frequencies not to exceed 5 years. The staff's review and evaluation of the Structures Monitoring Program is documented in SER Sections 3.03.2.22. The staff finds the applicant's proposal to manage the effects of aging using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program acceptable because the program provides for periodic visual inspections at specified frequencies to identify loss of material, cracking, increase in porosity and permeability, and loss of strength in the asbestos cement board consistent with GALL Report AMP XI.S7 and before there is a loss of component's intended function.

On the basis of its review, the staff concludes that for items in LRA Table 3.5.2-2 with an AERM, as amended by letter dated December 26, 2014, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.3 Turbine Building, Process Facilities, and Yard 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, process facilities, and yard structures component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERMs for the turbine building, process facilities, and yard structures component groups are consistent with the GALL Report.

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.

Carborundum Durablanket, Carborundum Fibersil Cloth, Fiberboard, Thermo-lag®, Silicon Elastomer, and Elastomer Fire Stops and Fire Wraps Exposed to Uncontrolled Indoor Air. In LRA Table 3.5.2-4, the applicant stated that carborundum durablanket, carborundum fibersil cloth, fiberboard, Thermo-lag®, silicone elastomer, and elastomer fire stops and fire wraps 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 item cites generic note J.

The staff noted that in Enhancement 2 to the Fire Protection Program, the applicant stated that it will revise procedures to require visual inspections of in-scope fire wrap and fire stop materials constructed of fibersil cloth, cerafoam, kaowool, Thermo-lag®, Flamemastic®, and Pyrocrete®; however, LRA Table 3.5.2-4 does not appear to include AMR items for these materials. Therefore, by letter dated December 17, 2014, the staff issued RAI 3.5.2-1, requesting that the applicant state whether cerafoam, kaowool, Flamemastic®, and Pyrocrete® are used as fire stops or fire wraps at Fermi 2 and, if so, explain how the effects of aging of these components and materials will be managed.

By letter dated January 15, 2015, the applicant stated that it inadvertently included cerafoam, kaowool, Flamemastic®, and Pyrocrete® as fire wrap and fire stop materials in the enhancements. The applicant revised the enhancement to remove the specific materials that are not installed in the plant.

The staff finds the applicant's response acceptable because the applicant revised the enhancement to remove materials that are not installed in the plant. Because the enhancement now generically refers to in-scope fire wrap and fire stop materials, the staff has reasonable assurance that all in-scope fire wrap and fire stop materials will be inspected. Therefore, the staff's concern in RAI 3.5.2-1 is resolved.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for the component, material, and environment description. Although the GALL Report does not have any AMR items for nonmetallic fire barriers (e.g., fire stops), the staff noted that GALL Report AMP XI.M26, "Fire Protection," does include aging management of fire resistant materials within the scope of the AMP. GALL Report AMP XI.M26 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 these component, material, and environment combinations.

The staff's evaluation of the applicant's Fire Protection Program is documented in SER Section 3.0.3.2.9. The staff finds the applicant's proposal to manage the effects of aging using the Fire Protection Program acceptable because the program includes visual inspections of fire barriers (e.g., fire stops and fire wraps) of various material types that are capable of detecting degradation of the fire barrier before loss of intended function.

Fiberglass, Calcium Silicate, Fiberfrax, Fiberfrax Ceramic Fiber Durablanket, and Insulfrax Insulation Exposed to an Air-Indoor Uncontrolled Environment. In LRA Table 3.5.2-4, the applicant stated that insulations of fiberglass, calcium silicate, Fiberfrax®, Fiberfrax® ceramic fiber durablanket, and Insulfrax® exposed to an 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 reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this component, material, and environment description. However, sufficient information had not been provided to understand how the Structures Monitoring Program adequately manages the aging effects for this component group to maintain the intended function of "providing insulating characteristics to reduce heat transfer." Therefore, by letter dated December 19, 2014, the staff issued RAI B.1.16-2, requesting that the applicant describe the insulation configuration and the activities in the Structures Monitoring Program that will be used to manage reduced thermal insulation resistance due to moisture intrusion, state whether the jacketing had been installed with procedures that include insulation configuration controls if the insulation is jacketed, and describe the parameters that will be monitored or inspected to ensure that the thermal function of the insulation is maintained.

In its response dated January 28, 2015, the applicant stated that the AMR item in LRA Table 3.5.2-4 will be revised to include insulation degradation due to moisture intrusion as an AERM and will reference the External Surfaces Monitoring Program as the AMP. By letter dated April 17, 2015, the applicant further revised this AMR item to reference both the External Surfaces Monitoring Program and the PSPM Program. The staff finds the applicant's proposal to manage the effects of aging using the combination of these two programs acceptable. The staff's evaluation of the applicant's PSPM Program is documented in SER Section 3.0.3.3.1. The staff's evaluation of the response to RAI B.1.16-2 is documented in SER Section 3.0.3.2.7.

On the basis of its review, the staff concludes that for items in LRA Table 3.5.2-4 with an AERM, the applicant has demonstrated that the effects of aging will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effect of aging for the containments, structures, and component supports 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).

3.6 Aging Management of Electrical and Instrumentation and Controls System

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and instrumentation and control (I&C) system components and commodity groups of the following items:

- high-voltage insulators
- non-EQ insulted cable and connections

- cable connections (metallic parts)
- electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
- electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
- electrical and I&C penetration cables and connections not subject to 10 CFR 50.49 EQ requirements
- fuse holders (insulation material)
- non-EQ fuse holders (metallic portion)
- inaccessible power (400 V to 13.8 kV) cables (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements

* 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 and I&C system components and component groups. LRA Table 3.6.1, "Summary of Aging Management Programs for the Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the electrical and I&C system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C 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 confirm its claim that certain AMRs are consistent with the GALL Report, not applicable, or not used. 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. The AMRs that the staff confirmed are consistent with the GALL Report are noted as such in SER Table 3.6-1, and no further discussion is required. The AMRs that the staff confirmed are not applicable to Fermi 2 or not used, because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Fermi 2 or because the component, material, and environment combination is addressed by another SER Table 3.5-1 item, or require no aging management are noted in SER 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 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 not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations of AMRs not consistent with, or not addressed in, the GALL Report are documented in SER Section 3.6.2.3.

SER Table 3.6-1 summarized the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.6 and addressed in the GALL Report.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls in the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of various polymeric and metallic materials exposed to adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage (3.6.1-1)	Various aging effects due to various mechanisms in accordance with 10 CFR 50.49	EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA	EQ equipment is not subject to aging management review because the equipment is subject to replacement based on a qualified life.	Consistent with the GALL Report (see SER Sections 3.6.2.2.1 and 4.4)
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, plant specific	NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (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
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, plant specific	NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (see SER Section 3.6.2.2.2)
Transmission conductors composed of aluminum; steel exposed to air – outdoor (3.6.1-4)	Loss of conductor strength due to corrosion	A plant-specific aging management program is to be evaluated for ACSR	Yes, plant specific	Consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."	Consistent with the GALL Report (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, plant specific	NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (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, plant specific	NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (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, plant specific	NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (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 and Environmental Qualification (EQ) of Electric Components programs	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 Instrumentation Circuits Test Review Program	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 to 13.8 kV) Program	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 Program	Consistent with the GALL Report
Metal enclosed bus: bus/connections composed of various metals used for electrical bus and connections exposed to air – indoor, controlled or uncontrolled or air – outdoor (3.6.1-12)	Increased resistance of connection due to the loosening of bolts caused by thermal cycling and ohmic heating	Chapter XI.E4, “Metal Enclosed Bus”	No	Metal Enclosed Bus Inspection Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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/thermo plastics, radiation-induced oxidation, moisture/debris intrusion, and ohmic heating	Chapter XI.E4, “Metal Enclosed Bus”	No	Metal Enclosed Bus Inspection Program	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 Program	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 Program	Consistent with the GALL Report
Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, uncontrolled (3.6.1-16)	Increased resistance of connection due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply); fatigue due to ohmic heating, thermal cycling, electrical transients	Chapter XI.E5, “Fuse Holders”	No	NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (see SER Section 3.6.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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	NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (see SER Section 3.6.2.1.1)
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 Cable Connections Program	Consistent with the GALL Report
Connector contacts for electrical connectors exposed to borated water leakage composed of various metals used for electrical contacts exposed to air with borated water leakage (3.6.1-19)	Increased resistance of connection due to corrosion of connector contact surfaces caused by intrusion of borated water	Chapter XI.M10, “Boric Acid Corrosion”	No	Not applicable	Not applicable to BWRs (see SER Section 3.6.2.1.1)
Transmission conductors composed of aluminum exposed to air – outdoor (3.6.1-20)	Loss of conductor strength due to corrosion	None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR)	None	NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” aging effects are not applicable to Fermi 2.	Not applicable to Fermi 2 (see SER Section 3.6.2.2.3)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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	None. Consistent with NUREG-1801, "Generic Aging Lessons Learned (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 the electrical and I&C system components:

- Metal Enclosed Bus Inspection
- Non-EQ Cable Connections
- Non-EQ Inaccessible Power Cables (400 V to 13.8 kV)
- Non-EQ Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections

LRA Table 3.6.2 summarizes AMRs for the electrical and I&C system 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 of 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 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, but 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 reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.6.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.6.1, item 3.6.1-19, the applicant claimed that the corresponding AMR item in the GALL Report is not applicable because the associated item is only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that this item only applies to PWRs; and finds that this item is not applicable to Fermi 2, which is a BWR.

For LRA Table 3.6.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable or not used. However, the staff had to review sources beyond the LRA and UFSAR or to issue one or more RAIs, or both, to verify the applicant's claim.

LRA Table 3.6.1, items 3.6.1-16 and 3.6.1-17, address the aging mechanisms and effects for fuse holders (metallic portion), including increased resistance of connection due to chemical contamination, corrosion, and oxidation or fatigue caused by ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration. The GALL Report recommends GALL Report AMP XI.E5, "Fuse Holders," to manage the following fuse holder (metallic portion) aging effects: (a) increased resistance of connection due to chemical contamination, (b) corrosion, and (c) oxidation or fatigue caused by ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration for this component group.

The applicant stated that these items are not applicable because the non-EQ fuse holders, located in the Class IE 260/130 VDC battery system, that support a license renewal function and are subject to an AMR are not subjected to an environment that requires aging management.

The staff evaluated the applicant's claim and finds it acceptable because operating experience, license renewal basis documents, and condition reports reviewed and walkdowns performed during the audit support the applicant's claim that the in-scope non-EQ fuse holders installed as part of the Class IE 260/130 VDC battery system are not subject to increased resistance of connection caused by frequent manipulation; vibration; or thermal fatigue caused by ohmic heating, thermal cycling, or electrical transients. Further, the staff finds that fuse holders are not located in an environment that would subject them to an environment causing an increased resistance of connection caused by chemical contamination, corrosion and oxidation.

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 evaluates aging management, as recommended by the GALL Report, for the electrical and I&C system components and provides 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 states that EQ is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Presence of Any Salt Deposits and Surface Contamination and Loss of Material Due to Mechanical Wear

High-Voltage Insulators Composed of Porcelain, Malleable Iron, Aluminum, Galvanized Steel, and Cement Exposed to Outdoor Air. LRA Section 3.6.2.2.2, "Degradation of Insulator Quality due to Presence of Any Salt Deposits and Surface Contamination and Loss of Material due to Mechanical Wear," associated with LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, addresses reduced insulation resistance and loss of material in high-voltage insulators exposed to salt deposits, surface contamination, and insulator mechanical wear due to wind-induced movement of the associated high-voltage insulator transmission conductor.

The applicant stated in the LRA that this item is not applicable because airborne materials can contaminate insulator surfaces, but the buildup of contamination is gradual and is usually removed by rain. The applicant also pointed out that the glazed surface of the insulator helps in the removal of dust, salt, and industrial effluent contamination. Fermi 2 is not located near the seacoast or near other sources of airborne particulates. The applicant therefore concluded that reduced insulation resistance due to surface contamination is not an applicable aging effect for high-voltage insulators at Fermi 2 and that a plant-specific AMP is not required.

For LRA Table 3.6.2 items corresponding to LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, the applicant stated that, for high-voltage insulators, mechanical wear and reduced insulation resistance and loss of material due to wind and movement of the associated transmission conductor are not credible aging effects at Fermi 2 and that a plant-specific AMP is not required for these aging effects. The applicant noted in its evaluation that high-voltage insulator wear has not been apparent during routine inspections. The applicant also stated that industry experience has shown transmission conductors do not normally swing and that movement due to substantial wind will subside after a short period. The applicant's LRA Table 3.6.2 indicates that the aging effect in the GALL Report for this component, material, and environmental combination is not applicable. The applicant cites generic note I for this item. The staff reviewed the associated items in the LRA to confirm that these aging effects are not applicable for this component, material, and environmental combination.

In its review of components associated with LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, the staff noted a discrepancy between LRA Table 3.6.1 and the corresponding items of LRA Table 3.6.2 in describing high-voltage insulator materials. Table 3.6.2 contradicts Table 3.6.1 in that Table 3.6.2 omits malleable iron and aluminum from the list of high-voltage insulator 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, including malleable iron and aluminum. In a letter dated January 14, 2015, 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 regarding high-voltage insulator material.

In its response dated February 12, 2015, the applicant stated that LRA Table 3.6.2, "Electrical Components," will be revised to include the material "aluminum" for high-voltage insulators. The applicant noted that malleable iron is implicitly included in LRA Table 3.6.2 because it lists galvanized metal, which according to EPRI TR-1013475, "Plant Support Engineering: License Renewal Handbook, Revision 1 to EPRI Report 1003057," dated February 2007, includes malleable iron, ductile iron, and drop-forged steel. With the applicant revising Table 3.6.2 to include the material component "aluminum" and the clarification provided by EPRI TR-1013475 to include malleable iron, 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's concern described in RAI 3.6.2.2.2-1 is resolved.

In LRA Table 3.6.2 items corresponding to LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, the applicant stated that, for 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 that 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 Fermi 2 (LRA Table 3.6.2, note I).

The staff noted that EPRI TR-1003057, "License Renewal Handbook," dated December 2001, 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 TR-1003057 indicates this mechanism is possible but that industry operating experience has shown that the transmission conductors are not designed to normally swing, and when they do swing (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 criterion, demonstrating that mechanical wear due to wind is not an applicable aging effect for Fermi 2.

In LRA Table 3.6.2 items corresponding to LRA Table 3.6.1, items 3.6.1-2 and 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 Fermi 2. The applicant concluded in the LRA that a plant-specific AMP is not required because Fermi 2 is not located near the seacoast or other sources of airborne particulate surface contamination.

The staff also notes that Fermi 2 is not located in the vicinity of neither salt water bodies nor industrial pollution; therefore, surface contamination of high-voltage insulators is minimized. In addition, rainfall and snow periodically wash away minor contamination, and the glazed insulator surface also aids contamination removal. The staff evaluated the applicant's claim and finds it acceptable because the applicant's evaluation was performed consistent with SRP-LR Section 3.6.2.2.2 criterion demonstrating that a reduced insulation resistance aging effect due to salt deposits or surface contamination of high-voltage insulators is not an applicable aging mechanism requiring management for Fermi 2.

3.6.2.2.3 Loss of Material Due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Preload

<u>Transmission Conductors Composed of Aluminum, Steel Exposed to Air-Outdoor</u>. In LRA Table 3.6.2, the applicant stated that, for LRA Table 3.6.1, item 3.6.1-4, transmission conductors composed of aluminum exposed to air-outdoor and aging effect/mechanism of loss of strength due to corrosion, there is no aging effect and that no AMP is proposed. LRA Table 3.6.2 cites generic note C that states, "Component is different, but consistent with material, environment, aging effect and AMP listed for NUREG-1801 line item."

The applicant stated that at Fermi 2, in-scope transmission conductors are all aluminum conductors (AAC), which are not subject to aging management because AAC conductors are similar in construction to aluminum conductor aluminum alloy-reinforced (ACAR) transmission conductors evaluated in the GALL Report. An AAC transmission conductor consists of aluminum alloy wires in a multilayer construction similar to ACAR transmission conductors except that the AAC conductors do not have an aluminum alloy core. Therefore, the applicant concluded that the GALL Report aging effects associated with aluminum conductor steel reinforced (ACSR) conductors are not applicable for Fermi 2 AAC transmission conductors.

The applicant referenced an Ontario Hydro study that included the results of ACSR laboratory and field tests, including the evaluation of conductor aging effects due to locations near pollution sources and major urban areas. The study reported that the aluminum layers retained their original properties to a large degree. This is consistent with GALL Report, item VI.A.LP-46, which states that a program is not needed for loss of conductor strength due to corrosion for ACAR transmission conductors. The AAC transmission conductors have the same corrosion resistant properties as the ACAR transmission conductors. Therefore, the applicant concluded that the loss of conductor strength is not an AERM for Fermi 2 AAC transmission conductors for the period of extended operation.

GALL Report Table VIA, item VI.A.LP-46, does not recommend an AMP nor further evaluation for transmission conductors of ACAR construction. The applicant stated that AAC conductors are similar in construction to ACAR conductors with both types of conductors less susceptible to the aging effects for ACSR transmission conductors. Although the applicant’s transmission conductor is of a different construction than that described in the GALL Report, the material, environment, and aging effect combination is representative of the aging degradation of AAC transmission conductor material. The staff finds that the applicant’s evaluation is consistent with the GALL Report aging mechanisms/effects with respect to aluminum transmission conductors.

The staff concludes that the Fermi 2 AAC transmission conductors of the in-scope switchyard components have a high degree of corrosion resistance because steel reinforcement is not used in this type of conductors. The applicant’s evaluation of AAC transmission conductor aging is consistent with GALL Report, item VI.A LP-46, which states that loss of conductor strength is not an applicable aging effect for similar transmission conductors. Therefore, the staff finds that loss of conductor strength due to corrosion of AAC transmission conductors is not an applicable aging effect at Fermi 2.

LRA Table 3.6.1, item 3.6.1-20, addresses loss of conductor strength due to corrosion in transmission conductors composed of aluminum exposed to air-outdoor. The applicant states that Table 3.6.1, item 3.6.1-20, is not applicable to Fermi 2 because, as shown in the GALL Report, an AMP and further evaluation are not recommended for ACAR-type all-aluminum transmission conductors. In addition, SRP-LR Table 3.6-1, “Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter V1 of the GALL Report,” ID 20, Component, “Transmission Conductors Composed of Aluminum Exposed to Air – Outdoor,” also recommends no AMP or further evaluation for this component, material, and environment combination.

<u>Transmission Connectors Composed of Aluminum and Steel Exposed to an Air-Outdoor Environment</u>. In LRA Table 3.6.2, the applicant stated that, for LRA Table 3.6.1, item 3.6.1-5, transmission connectors composed of aluminum, steel, steel alloy exposed to an air-outdoor environment, and aging effect/mechanism of increased resistance of connection due to oxidation or loss of preload are not applicable and that no AMP is proposed. The AMR item cites generic note I that states, “Aging effect in NUREG-1801 for this component, material, and environment combination is not applicable.”

The applicant stated that switchyard connections can be susceptible to increased resistance due to corrosion. Fermi 2 air quality, due to the fact that its location is away from any industrial facilities and is free from salty moisture, is not a contributing factor to aging degradation due to corrosion. At Fermi 2, switchyard connection surfaces are coated with an antioxidant compound that provides a corrosion-resistant low electrical resistance connection. Fermi 2 also performs quarterly infrared inspections of the switchyard connections. These inspections and absence of operating experience problems at Fermi 2 indicate that increased connection resistance due to general corrosion and oxidation is not an AERM.

The applicant stated that due to the design of the transmission switchyard conductors and bus bolted connections, torque relaxation (loss of preload) is precluded. The design calls for use of Belleville washers and antioxidant compounds to preclude connection degradation due to loss of preload. The operating experience at Fermi 2, as indicated by quarterly infrared inspections of connections, has confirmed the absence of loss of preload. Therefore, increased connection resistance due to loss of preload of transmission conductor connections and switchyard bus connections is not an AERM at Fermi 2.

The staff reviewed the associated items in the LRA to confirm that these aging effects are not applicable for this component, material, and environmental combination. The staff finds the applicant's evaluation acceptable in accordance with the review described below.

The staff's evaluation concludes that the Fermi 2 switchyard buses are located in an area away from industrial air pollution; therefore, the aluminum bus material is not expected to exhibit significant aging effects. In addition, switchyard connections employ corrosion inhibitors and bolting practices using washers that prevent loss of preload and limit vibration. Therefore, the staff concludes that corrosion, oxidation, and loss of preload are not considered an applicable aging mechanism for Fermi 2.

<u>Switchyard Bus Connections Composed of Aluminum, Copper, Bronze, Stainless Steel, Galvanized Steel Exposed to Air-Outdoor</u>. In LRA Table 3.6.2, the applicant stated that, for LRA Table 3.6.1, item 3.6.1-6, switchyard bus connections composed of aluminum, copper, bronze, stainless steel, and galvanized steel exposed to an air-outdoor environment; aging effect/mechanism of loss of material due to wind-induced abrasion; and increased resistance of connection due to oxidation or loss of preload are not applicable and that no AMP is proposed. The AMR item cites generic note I that states, "Aging effect in NUREG-1801 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 environmental combination. The staff finds the applicant's evaluation acceptable in accordance with the review described below.

The applicant reviewed loss of material (wear) due to wind particulates and vibration caused by operation of active switchyard components and concluded that they are not applicable AERMs. The staff noted that wind-born particulates have not been shown to be a contributor to loss of material. 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. Therefore, the staff finds that the loss of material (wear) due to wind induced abrasion and vibration is not a significant AERM for transmission conductors and connections at Fermi 2.

The applicant stated that switchyard connections can be susceptible to increased resistance due to corrosion. Fermi air quality, due to the fact that its location is away from any industrial facilities and is free from salty moisture, is not a contributing factor to aging degradation due to corrosion. At Fermi, switchyard connection surfaces are coated with an antioxidant compound that provides a corrosion-resistant low electrical resistance connection. Fermi also performs quarterly infrared inspections of the switchyard connections. These inspections and absence of operating experience problems at Fermi indicates that increased connection resistance due to general corrosion and oxidation is not an AERM.

The applicant stated that due to the design of the transmission switchyard conductors and bus bolted connections, torque relaxation (loss of preload) is precluded. The design calls for use of Belleville washers and antioxidant compounds to preclude connection degradation due to loss of preload. The operating experience at Fermi, as indicated by quarterly infrared inspections of connections, has confirmed the absence of loss of preload. Therefore, increased connection resistance due to loss of preload of transmission conductor connections and switchyard bus connections is not an AERM at Fermi 2.

The staff reviewed the associated items in the LRA to confirm that these aging effects are not applicable for this component, material, and environmental combination. The staff finds the applicant's evaluation acceptable per the review described below.

The staff's evaluation concludes that the Fermi 2 switchyard buses are located in an area away from industrial air pollution; therefore, the bus material is not expected to exhibit significant aging effects. The staff also noted that wind-born particulates have not been shown to be a contributor to loss of material through abrasion. In addition, switchyard connections employ corrosion inhibitors and bolting practices using washers that prevent loss of preload and limit vibration. Therefore, the staff concludes that abrasion, corrosion, oxidation, and loss of preload are not considered an applicable aging mechanism for switchyard bus and connections at Fermi 2.

Transmission Conductors Composed of Aluminum, Steel Exposed to Air-Outdoor. In LRA Table 3.6.2, the applicant stated that, for LRA Table 3.6.1, item 3.6.1-7, transmission conductors composed of aluminum and steel exposed to an air-outdoor environment and aging effect/mechanism of loss of material due to wind-induced abrasion are not applicable and that no AMP is proposed. The AMR item cites generic note I that states, "Aging effect in NUREG-1801 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 environmental combination. The staff finds the applicant's evaluation acceptable in accordance with the review described below.

The applicant reviewed loss of material (wear) due to wind particulates and concluded that they are not applicable AERMs. The staff noted that wind-born particulates have not been shown to be a contributor to loss of material. Therefore, the staff finds that the loss of material (wear) due to wind-induced abrasion is not a significant AERM for transmission conductors and connections at Fermi 2.

On the basis of its review, the staff concludes that the applicant has met the SRP-LR Section 3.6.2.2.3 criteria. For those line 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 for AMPs.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Table 3.6.2, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Table 3.6.2, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.6.2.3.1 Electrical and I&C Components – Summary of Aging Management Evaluation – LRA Table 3.6.2

The staff reviewed LRA Table 3.6.2, 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, the applicant stated that high-voltage insulators, composed of porcelain, malleable iron, aluminum, galvanized steel, and cement exposed to an air-outdoor environment, are not applicable and that no AMP is proposed. The AMR item cites 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 environmental 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 claim is documented in SER Section 3.6.2.2.2.

Transmission Connectors Composed of Aluminum, Steel and Steel Alloy, 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, the applicant stated that transmission connectors composed of aluminum, steel exposed to an air-outdoor environment; switchyard bus and connectors composed of copper, bronze, stainless steel, and galvanized steel exposed to an air-outdoor environment; and transmission conductors composed of aluminum and steel exposed to an air-outdoor environment are not applicable and that no AMP is proposed. The AMR item cites 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 environmental combinations. The staff finds the applicant's proposal acceptable based on the applicant's further evaluation performed consistent with the SRP-LR Section 3.6.2.2.2 criterion. The staff's evaluation of the applicant's claim is documented in SER Section 3.6.2.2.3.

Fuse Holders (Not Part of Active Equipment) Metallic Clamps Composed of Various Metals Used for Electrical Connections Exposed to Air-Outdoor Controlled or Uncontrolled. In LRA Table 3.6.2, the applicant stated that fuse holders (that are not part of active equipment) metallic clamps composed of various metals used for electrical connections exposed to an air-indoor controlled or uncontrolled environment are not applicable and that no AMP is proposed. The AMR item cites 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 components, material, and environmental combinations. The staff finds the applicant's proposal acceptable based on operating experience, license renewal basis documents, condition reports, and walkdowns performed during the audit, which support the applicant's claim that in-scope non-EQ fuse holders installed as part of the Class IE 260/130 VDC battery system are not subject to the aging mechanisms and effects, as referenced by the GALL Report. The staff's evaluation of the applicant's claim is documented in SER Section 3.6.2.1.1.

On the basis of its review, the staff concludes that for items in LRA Table 3.6.2 with no AERMs, the applicant has appropriately evaluated the material and environment combinations not addressed in the GALL Report, and their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effect of aging for the electrical and instrumentation and controls 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 and Activities." On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable UFSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).

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 made in order to comply with 10 CFR 54.21(a)(1), in accordance with the Atomic Energy Act of 1954, as amended, and in accordance with NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This section of the safety evaluation report (SER) provides the U.S. Nuclear Regulatory Commission (NRC) staff (the staff) evaluation of the applicant's basis for identifying those plant-specific or generic analyses that need to be identified as time-limited aging analyses (TLAAs) for the applicant's license renewal application (LRA) and the list of TLAAs for the LRA. 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 those exemptions that need to be identified in the LRA.

Pursuant to the requirements in Title 10 of the *Code of Federal Regulations* 54.21(c)(1) (10 CFR 54.21(c)(1)), an applicant for license renewal must list all evaluations, analyses, and calculations in the current licensing basis (CLB) that conform to the definition of a TLAA, as defined in 10 CFR 54.3, "Definitions."

The NRC regulations in 10 CFR 54.3 state that a plant-specific or generic evaluation, analysis, or calculation is a TLAA if it meets all six of the following TLAA identification criteria:

(1) involves a system, structure, or component (SCC) that is within the scope of license renewal, as delineated in 10 CFR 54.4(a)

(2) considers the effect or effects of aging

(3) involves time-limited assumptions that are defined by the current operating term (e.g., 40 years)

(4) was determined to be relevant by the applicant in making a safety determination

(5) involves conclusions, or provides the basis for conclusions, related to the capability of the SSC to perform its intended function(s), as described in 10 CFR 54.4(b)

(6) is contained or incorporated by reference in the CLB

For each evaluation, analysis, or calculation that is a TLAA, the applicant must demonstrate that the TLAA will be acceptable for the period of extended operation in accordance with one of the following three acceptance criteria for TLAAs in 10 CFR 54.21(c)(1):

(i) demonstration that the TLAA will remain valid for the period of extended operation

(ii) demonstration that the TLAA has been projected to the end of the period of extended operation

(iii) demonstration that the effects of aging on the intended function(s) will be adequately managed during the period of extended operation

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list all plant-specific exemptions in the CLB that were granted in accordance with the exemption approval criteria in 10 CFR 50.12, "Specific Exemptions," and that are based on a TLAA. For any such exemptions, the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

The staff's guidance for reviewing LRA Section 4.1 is given in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), Section 4.1, "Identification of Time-Limiting Aging Analyses," dated December 2010. SRP-LR Section 4.1.1 summarizes the areas of review. SRP-LR Section 4.1.2 provides the staff's "acceptance criteria" for performing TLAA and LRA exemption identification reviews. SRP-LR Section 4.1.3 provides the staff's "review procedures" for performing the TLAA and LRA exemption identification reviews. SRP-LR Table 4.1-1 provides some case-by-case examples on whether a given analysis category would be required to be identified as a TLAA for an LRA. SRP-LR Table 4.1-2 provides a list of those analyses or calculations that normally are part of an applicant's CLB and that are normally identified as TLAAs (i.e., generic TLAAs). SRP-LR Table 4.1-3 provides a list of those analyses or calculations that may be identified as plant-specific TLAAs.

4.1.1 Summary of Technical Information in the Application

4.1.1.1 Identification of Time-Limited Aging Analyses

LRA Section 4.1 states that the applicant reviewed and evaluated the analyses and calculations in the CLB for Fermi 2, against the six criteria for TLAAs in 10 CFR 54.3. The LRA also states that the applicant reviewed the list of TLAAs in the SRP-LR to see if they are applicable to and included as part of the applicant's CLB. The applicant stated that it used the following guidance documents as of part of its bases for TLAA identification methodology: (1) SRP-LR, (2) Nuclear Energy Institute (NEI) 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – the License Renewal Rule," (3) 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," (4) NRC SERs, (5) docketed licensing correspondence, (6) Fermi 2 updated final safety analysis report (UFSAR), (7) Fermi 2 Technical Specifications (TS), and (8) industry topical reports (relevant documents referenced in the UFSAR or in docketed licensing correspondence).

The applicant provided its list of TLAAs in LRA Table 4.1-1, "List of TLAAs." In this table, the applicant indicates that the following evaluations, analyses, or calculations in the CLB meet the six criteria for TLAAs in 10 CFR 54.3 and are TLAAs for the LRA:

- reactor vessel neutron embrittlement analyses (LRA Section 4.2)
- metal fatigue analyses (LRA Section 4.3)
- environmental qualification (EQ) analyses of electric equipment (LRA Section 4.4)
- containment liner plate, metal containment, and penetrations fatigue analyses (LRA Section 4.6)
- other plant-specific TLAAs (LRA Section 4.7)

The applicant provided its bases for accepting these TLAAs in accordance with either 10 CFR 54.21(c)(1)(i), (ii), or (iii) in the applicable subsections of LRA Sections 4.2 – 4.7.

The applicant indicates that the following generic evaluations, analyses, or calculations listed in SRP-LR Table 4.1-2 are not part of the Fermi 2 CLB and therefore do not need to be identified as applicable TLAAs for the LRA:

- concrete containment tendon prestress analyses
- inservice local metal containment corrosion analyses

The applicant indicates that the following potentially applicable plant-specific evaluations, analyses, or calculations listed in SRP-LR Table 4.1-3 are not part of the Fermi 2 CLB and therefore do not need to be identified as applicable TLAAs for the LRA:

- reactor pressure vessel (RPV) underclad intergranular separation (underclad cracking)
- low-temperature overpressure protection (LTOP) analyses
- fatigue analysis for main steam supply lines to the turbine-driven auxiliary feedwater (AFW) pumps
- fatigue analysis of the reactor coolant pump (RCP) flywheels
- flow-induced vibration endurance limit for the reactor vessel internals (RVIs)
- ductility reduction of fracture toughness for the RVIs
- leak-before-break (LBB)
- metal corrosion allowance

4.1.1.2 Identification of Exemptions

The applicant stated that it performed a search in accordance with the exemption approval criteria in 10 CFR 50.12 to find any exemptions that were granted for the Fermi 2 CLB and were based on a TLAA. The applicant stated it performed its search based on a review of relevant licensing basis or design basis information in the UFSAR, American Society of Mechanical Engineers (ASME) Code Section XI Program documentation, fire protection documents, operating license, TS and docketed correspondence. The applicant stated that it did not find any exemptions that were based on a TLAA and will remain in effect for the period of extended operation.

4.1.2 Staff Evaluation

4.1.2.1 Identification of TLAAs

The staff reviewed the applicant's methodology for identifying the TLAAs and the TLAA results for the LRA against the six criteria for TLAA identification in 10 CFR 54.3 and the list of TLAAs in SRP-LR Section 4.1, including the analyses in SRP-LR Table 4.1-2 that are normally generic TLAAs for the U.S. nuclear power industry and the list of analyses in SRP-LR Table 4.1-3 that may be plant-specific TLAAs for the industry. The staff used the "acceptance criteria" in SRP-LR Section 4.1.2 and the review procedures in SRP-LR Section 4.1.3 as the basis for its review.

To verify the completeness of the applicant's list of TLAAs, the staff reviewed LRA Appendix C, "Response to BWRVIP Applicant Action Items," which provides the applicant's responses to those applicant action items (AAIs) that were issued by the NRC on the applicant's bases for implementing specific Electric Power Research Institute (EPRI) BWRVIP technical report methodologies during the period of extended operation. This review is provided in SER Section 4.1.2.1.2. SER Section 3.0.3.2.3 provides the staff's evaluations of the AAI responses that were provided in the LRA for non-TLAA-related topics.

4.1.2.1.1 Evaluations, Analyses, and Calculations in the CLB Conforming to 10 CFR 54.3 TLAA Criteria

LRA Table 4.1-1 identifies those generic analyses and plant-specific analyses in the CLB that have been identified as TLAAs for the LRA. The staff concluded that these analyses are in conformance with the six criteria for defining TLAAs in 10 CFR 54.3. Based on its review, the staff finds that the identification of these TLAAs is acceptable because it is in accordance with the requirement in 10 CFR 54.21(c)(1). The staff's evaluation of the applicant's demonstration for each TLAA in accordance with 10 CFR 54.21(c)(1) is documented in 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 in the CLB That Do Not Conform to Six Criteria for TLAAs in 10 CFR 54.3 or Absence of a TLAA due to Absence of a Particular Analysis in the CLB

As discussed in Section 4.1.1.1, the applicant identified a number of evaluations, analyses, and calculations in the SRP-LR that either do not apply to the Fermi 2 CLB or do not meet the definition of a TLAA in 10 CFR 54.3(a). The staff's evaluation of the applicant's statements and bases for these matters are provided below.

Absence of a Containment Tendon Prestress TLAA. SRP-LR Table 4.1-2 and SRP-LR Section 4.5 both identify that a containment tendon prestress analysis is a generic TLAA that may be applicable to plant containment designs. SRP-LR Section 4.5 states that containment prestress analyses are only applicable to concrete containment structures that use prestressed tendons as the reinforcement basis for the structures.

The applicant stated that the CLB does not include a containment tendon prestress analysis because Fermi 2 uses a General Electric (GE) Mark I containment design that does not include prestressed tendons.

The staff reviewed the Fermi 2 UFSAR and confirmed that the CLB for Fermi 2's Mark I containment structure does not rely on prestressed tendons to reinforce the structure. Therefore, the staff concludes that the LRA does not need to include a concrete containment prestress TLAA because the staff confirmed that this type of analysis is not included in the CLB.

Absence of an Inservice Localized Metal Containment Corrosion TLAA. SRP-LR Table 4.1-2 identifies that a local metal containment corrosion analysis is a generic TLAA that may be applicable to plants. The applicant stated that the CLB does not include any inservice local metal containment corrosion analyses because the containment is a GE Mark I containment design and the CLB does not include any corrosion analysis associated with this type of containment design.

The staff reviewed the UFSAR and noted that the CLB for Fermi 2's Mark I containment structure does not rely on localized metal corrosion analyses to justify the structural integrity of metallic containment components against the consequences of corrosion-induced aging effects. The staff confirmed that the applicant relies on the application of coatings and pH control to achieve this objective. Therefore, the staff concludes that the LRA does not need to include a localized metal containment corrosion TLAA because the staff has confirmed that this type of analysis is not included in the CLB.

Absence of a TLAA on RPV Underclad Intergranular Separation (Underclad Cracking). SRP-LR Table 4.1-3 identifies that a plant-specific RPV underclad cracking analysis may qualify as a TLAA for plants. The applicant stated that the CLB does not include any analysis of intergranular separations (i.e., underclad cracks or underclad cracking) in the RPV because this analysis is not applicable to boiling water reactor (BWR) designs.

The staff noted that the relevant TLAA recommendations in the SRP-LR for RPV underclad cracking analyses are only applicable to SA-508, Class 2 forgings in pressurized water reactor (PWR)-designed RPVs and do not apply to BWR designs. The staff reviewed the UFSAR and verified that the UFSAR defines that the Fermi 2 reactor is a GE Model 4 BWR design. Therefore, the staff concludes that the LRA does not need to include a plant-specific RPV underclad cracking TLAA because this type of analysis is not applicable to BWRs.

Absence of a Low-Temperature Overpressure Protection (LTOP) TLAA. SRP-LR Table 4.1-3 identifies a plant-specific LTOP analysis that may qualify as a TLAA for plants. The applicant stated that the CLB does not include an LTOP analysis for the RPV and reactor coolant pressure boundary (RCPB) because this analysis is not applicable to BWR designs.

The staff noted that the relevant TLAA recommendations for plant-specific LTOP analyses in the SRP-LR are only applicable to the reactor coolant systems in PWR-designed reactors and do not apply to BWR designs. The staff reviewed the UFSAR and confirmed that the Fermi 2 reactor is a GE Model 4 BWR design. Therefore, the staff concludes that the LRA does not need to include a plant-specific LTOP TLAA because this type of analysis is not applicable to BWRs.

Absence of a Fatigue Analysis for Main Steam Supply Lines to Steam-Driven Auxiliary Feedwater (AFW) Pumps TLAA. SRP-LR Table 4.1-3 identifies a plant-specific metal fatigue analysis for the steam line that supplies steam to a steam-driven AFW pump as a possible TLAA for plants. The applicant stated that the CLB does not include this type of fatigue analysis because the analysis does not apply to BWR designs.

The staff noted that the relevant TLAA recommendations in the SRP-LR for these types of plant-specific fatigue analyses are only applicable to PWR designs that include steam-driven AFW pumps and do not apply to BWR designs. The staff reviewed the UFSAR and confirmed that the Fermi 2 reactor is a GE Model 4 BWR design. Therefore, the staff concludes that the LRA does not need to include a plant-specific fatigue TLAA for steam-driven AFW pump steam supply lines because this type of analysis is not applicable to BWRs.

Absence of a Fatigue Flaw Growth Analysis for Reactor Coolant Pump (RCP) Flywheels TLAA. SRP-LR Table 4.1-3 identifies a plant-specific cycle-dependent fatigue growth or flaw tolerance analysis for RCP flywheels that may qualify as a TLAA for plants. The applicant stated that the CLB does not include any cycle-dependent flaw growth or flaw tolerance analysis for RCP flywheels because this analysis does not apply to BWR designs.

The staff noted that the relevant TLAA recommendations in the SRP-LR for RCP flywheel fatigue flaw growth analyses are only applicable to the designs of the RCPs in PWR plant designs and do not apply to BWR plant designs. The staff reviewed the UFSAR and confirmed that the Fermi 2 reactor is a GE Model 4 BWR design. Therefore, the staff concludes that the LRA does not need to include a plant-specific RCP flywheel TLAA because this type of analysis is not applicable to BWRs.

<u>Absence of a Flow-Induced Vibration Analysis for Reactor Vessel Internal (RVI) Components TLAA</u>. SRP-LR Table 4.1-3 identifies a plant-specific flow-induced vibration analysis for the RVI components that may qualify as a TLAA for plants. The applicant stated that the flow-induced vibration analysis for the RVI components in the CLB is not a TLAA because it is not based on the current operating term such as 40 years and thus does not conform to the definition of a TLAA in 10 CFR 54.3(a).

The staff noted that UFSAR Section 1.5.2.3 states that flow-induced vibrations of the RVI components were qualified by prototypical testing performed in accordance with GE Report No. NEDO-24057-P, "Assessment of Reactor Internals Vibration in BWR/4 and BWR/5 Plants," dated November 1977, and that this report provides the design basis for demonstrating conformance with NRC Regulatory Guide (RG) 1.20, Revision 2, "Comprehensive Vibration Assessment Program for Reactor Internals during Preoperational and Initial Startup Testing," dated May 1976. However, the staff noted that the UFSAR did not indicate whether the methodology in GE Report No. NEDO-24057-P included a time-dependent analysis for qualifying the structural integrity of the RVI components against the consequences of flow-induced vibrations.

By letter dated December 23, 2014, the staff issued Request for Additional Information (RAI) 4.1-1, requesting that the applicant clarify whether the methodology in GE Report No. NEDO-24057-P included a time-dependent analysis, and if so, whether the analysis is relied upon to qualify the structural integrity of the RVI components against the consequences of flow-induced vibrations. If the analysis is time-dependent, the staff asked the applicant to provide justification as to why it would not need to be identified as a TLAA, when compared to the six criteria for TLAAs in 10 CFR 54.3(a).

By letter dated February 5, 2014, as amended by letter dated April 10, 2014, the applicant responded to RAI 4.1-1. In its response, the applicant stated that the methodology in TR No. NEDO-24057-P does not include a time-dependent analysis as long as the flow-induced vibration stress is less than 10,000 psi. The applicant stated that, based on startup vibration measurements at the prototype plant, the maximum peak stress amplitude due to flow induced vibrations is less than 10,000 psi. The applicant also stated that, since the value is less than 10,000 psi, no fatigue usage is accumulated by the component as a result of flow-induced vibrations and operating time has no effect on the RVI component evaluation.

The staff compared the applicant's basis in the response to RAI 4.1-1 to the information in ASME Code Section III, Subsection NB-3600, and stress-number (S-N) criteria in Figure I-9.2.2-1 of ASME Code Section III. The staff confirmed that, at vibrational stress levels less than 10,000 psi, the magnitude of the stresses is below those in Figure 1-9.2.2-1 that would identify fatigue as a potential issue for the RVI components. Therefore, based on this review, the staff confirmed that the criteria in ASME Code Section III, Subsection NB-3600, would not have required the applicant to perform a fatigue usage factor analysis for vibrational loads in the components. Therefore, based on its review of this analysis, the staff has confirmed that the assessment of vibrational loads for RVI components in NEDO-24057-P does not include any analysis that would need to be identified as a TLAA. The staff's concern described in RAI 4.1-1 is resolved.

Therefore, based on this review, the staff concludes that the assessment of vibrational loads in Report NEDO-24057-P does not need to be identified as a TLAA because the assessment does not: (a) involve an assessment of an applicable aging effect, and (b) conform to Criterion 2 in 10 CFR 54.3(a).

Absence of a Reduction of Ductility Analysis for Reactor Vessel Internal (RVI) Components TLAA. SRP-LR Section 3.1.2.2.3 (item 3) and SRP-LR Table 4.1-3 state that the CLB for PWRs designed by the Babcock & Wilcox Company may include a reduction of ductility TLAA for the RVI components in these types of plant designs; the applicable analysis is given in Technical Report (TR) No. BAW-2248A, “Demonstration of the Management of Aging Effects for the Reactor Vessel Internals” (Agencywide Documents Access and Management System (ADAMS) Accession No. ML003708443), dated April 2000.

LRA Table 4.1-2 states that the CLB does not include any time-dependent reduction of ductility analysis for the RVI components. LRA Section 3.1.2.2.3, item 3, states that this analysis pertains to a plant-specific TLAA for Babcock & Wilcox reactor internals and is therefore not applicable to Fermi 2.

The staff reviewed the UFSAR and confirmed that the Fermi 2 reactor is a GE designed BWR Model 4 reactor. Therefore, consistent with the analysis that has been provided in LRA Section 3.1.2.2.3, item 3, the staff concludes that the LRA does not need to include a reduction of ductility TLAA because this type of analysis is not applicable to BWRs.

Absence of a Leak-Before-Break (LBB) TLAA. SRP-LR Table 4.1-3 identifies a plant-specific LBB analysis that may qualify as a TLAA for plants.

LRA Table 4.1-2 states that the CLB does not include any time-dependent LBB analysis for plant design. LRA Table 4.1-2 also states that Fermi 2 does not credit the use of LBB technology. The staff reviewed the UFSAR and confirmed that the Fermi 2 reactor is a GE designed BWR Model 4 reactor. Therefore, the staff concludes that the LRA does not need to include an LBB TLAA because this type of analysis is not applicable to BWRs.

Absence of a Component Metal Corrosion Allowance Analyses TLAA. SRP-LR Table 4.1-3 identifies a plant-specific metal component corrosion allowance analysis that may qualify as a TLAA for plants. In LRA Table 4.1-2, the applicant stated that the CLB does not include any time-dependent metal corrosion allowance evaluations for metallic components that would need to be identified as TLAAs.

The staff reviewed the UFSAR and noted that it did not identify any specific cases of metallic components with corrosion allowances where the additional amount of metal material in the component designs were established by a time-dependent analysis. Therefore, based on its review, the staff concludes that the LRA does not need to include any corrosion allowance TLAAs because the staff has confirmed that the CLB does not include these types of TLAAs.

Potentially Applicable TLAAs in Response to BWRVIP Report Applicant Action Items. The staff noted that inclusion of LRA Aging Management Program (AMP) B.1.11, “BWR Vessel Internals,” confirms that the applicant applies the BWRVIP inspection and flaw evaluation (I&FE) guideline reports as part of its basis for managing aging effects applicable to the RVI components at Fermi 2. Therefore, the staff reviewed the NRC-issued safety evaluations (SEs) on the BWRVIP reports that are referenced in the Generic Aging Lessons Learned (GALL) Report AMPs XI.M4, “BWR Vessel ID Attachment Welds,” XI.M8, “BWR Vessel Penetrations,” and XI.M9, “BWR Vessel Internals,” to determine whether the SEs included applicable TLAA-related AAIs for the specific RVI components that are within the scope of the BWRVIP reports. The staff’s review included a review of the following BWRVIP report SEs:

- SE on Report No. BWRVIP-18, Revision 1-A (I&FE guidelines for BWR core spray internals)
- SE on Report No. BWRVIP-25 (I&FE guidelines for BWR core plates)
- SE on Report No. BWRVIP-26-A (I&FE guidelines for BWR top guides)
- SE on Report No. BWRVIP-27-A (I&FE guidelines for BWR standby liquid control/core ΔP (SLC/core ΔP) nozzles and lines)
- SE on Report No. BWRVIP-38 (I&FE guidelines for core shroud supports)
- SE on Report No. BWRVIP-41, Revision 3 (I&FE guidelines for jet pump assembly components)
- SE on Report No. BWRVIP-42-A (I&FE guidelines for BWR low-pressure coolant injection (LPCI) couplings)
- SE on Report No. BWRVIP-47-A (I&FE guidelines for BWR RVI lower plenum components
- SE on Report No. BWRVIP-74-A (I&FE guidelines for BWR reactor pressure vessel (RPV) components)
- SE on Report No. BWRVIP-76, Revision 1-A (I&FE guidelines for BWR core shrouds)

The staff noted that, of these reports, only BWRVIP-18, Revision 1-A, BWRVIP-25, BWRVIP-26-A, BWRVIP-27-A, BWRVIP-42-A, BWRVIP-47-A, BWRVIP-74-A, and BWRVIP-76, Revision 1-A, included AAIs that relate to the identification of TLAAs.

AAI No. 4 on BWRVIP-18-A (BWRVIP I&FE Guidelines for Internal BWR Core Spray Lines). In the staff's SE on BWRVIP-18-A, dated December 7, 2000 (ADAMS Accession No. ML003775973), and approval letter for BWRVIP-18, Revision 1-A, dated May 2, 2013 (ADAMS Accession No. ML13067A072), the staff issued AAI No. 4, requesting that BWR applicants identify any plant-specific TLAAs that may be applicable to the evaluation of BWR core spray line (internal portions) and sparger components. Specifically, in this AAI, the staff stated that BWR applicants for renewal should identify all TLAAs that are applicable to the design of its core spray internal components.

In its response to this AAI, the applicant stated that the metal fatigue TLAAs have been identified for the core spray lines and the core spray spargers and the TLAAs are discussed in LRA Section 4.3.1.4.

The staff confirmed that the applicant discusses its metal fatigue TLAA (i.e., cumulative usage factor (CUF) analysis) for the internal portion of the core spray line and core spray sparger in LRA Section 4.3.1.4. The staff also confirmed that the fatigue analysis for the internal portions of the core spray line and sparger was the only analysis that conformed to the definition of a TLAA in 10 CFR 54.3(a).

Based on this review, the staff finds the applicant's response to this AAI acceptable because the staff has confirmed that the applicant has included the applicable fatigue TLAA for the core spray line and sparger components in the LRA and because the design basis does not include any other analysis that needs to be identified as a TLAA for these components. The staff evaluation of the CUF analysis for the internal portions of the core spray line and the core spray sparger is documented in SER Section 4.3.1.4.2.

AAI No. 4 on BWRVIP-25 (BWRVIP I&FE Guidelines for BWR Core Plates). In the staff's SE on BWRVIP-25, dated December 7, 2000 (ADAMS Accession No. ML003775989), the staff issued AAI No. 4, requesting BWR applicants to identify any plant-specific TLAAs that may be applicable to the evaluation of BWR core plate assemblies or the components in these assemblies. Specifically, in this AAI, the staff stated that BWR applicants for license renewal should identify and evaluate whether the evaluation of stress relaxation in core plate rim hold-down bolts should be identified as a TLAA for the components.

In its response to this AAI, documented in LRA Appendix C, the applicant stated that, at Fermi 2, the structural integrity of the core plate is not ensured by the inclusion of wedges that hold the core plate in place; instead, the Fermi 2 design relies on rim hold-down bolts that are tensioned (preloaded) in place. To address AAI No. 4 on BWRVIP-25, the applicant stated that the BWR Vessel Internals Program (LRA AMP B.1.10) will be enhanced (Commitment No. 7, Part c), in part, to perform one of the following activities:

- Option (a) - Install wedges in the core plate design prior to entering the period of extended operation.
- Option (b) - Complete a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25 and submit the inspection plan, along with the acceptance criteria and justification for the inspection plan, to the NRC 2 years prior to the period of extended operation.

The staff noted that the applicant identified these activities as applicable program enhancements to the BWRVIP Vessel Internals Program in LRA UFSAR supplement Section A.1.10 and committed to these activities in Commitment No. 7 of UFSAR Supplement Table A.4, "License Renewal Commitment List." However, the staff noted that some aspects of Commitment No. 7, Part c, would need to be clarified, particularly if Option (b) of the commitment is selected as the basis for managing aging in the plant's core plate rim hold-down bolts.

Specifically, the staff noted that Option (b) of Commitment No. 7, Part c, does not address whether the analysis will evaluate loss of preload due to stress relaxation in the core plate rim hold-down bolts and whether the analysis will quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. Presuming that the analysis in Option (b) will be a loss of preload/stress relaxation analysis, the staff noted that the option does not identify whether the analysis will be based on the generic loss of preload/stress relaxation analysis in BWRVIP-25, as approved in the staff's SE of December 7, 2000, or a plant-specific loss of preload/stress relaxation analysis that is applicable to the plant-specific design of the core plate rim hold-down bolts at Fermi 2. The staff also noted that Option (b) of LRA Commitment No. 7, Part c, does not require the applicant to submit the applicable analysis to the NRC for staff approval (i.e., if not already approved by the NRC).

By letter dated December 23, 2014, the staff issued RAI 4.1-2, Parts (a) – (c), requesting that the applicant provide further clarifications and justifications relative to Option (b) of LRA Commitment No. 7, Part c, as provided in LRA UFSAR Supplement Table A.4.

In RAI 4.1-2, Part (a), the staff requested the applicant to clarify whether the specific analysis in Option (b) of LRA Commitment No. 7, Part c, will address loss of preload due to stress relaxation in the core plate rim hold-down bolts, and if so whether the analysis will quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. If not, the staff asked the applicant to justify why the analysis would not quantify the amount of preload loss/stress relaxation that would occur in the core plate rim hold-down bolts at the end of the period of extended operation.

In RAI 4.1-2, Part (b), the staff requested the applicant to clarify whether the analysis referred to in Option (b) of LRA Commitment No. 7, Part c, will be a plant-specific loss of preload/stress relaxation analysis for the core plate rim hold-down bolts or the generic analysis loss of preload/stress relaxation analysis that was evaluated in BWRVIP-25 and approved in the staff's SE of December 7, 2000. If the analysis will be the generic analysis in BWRVIP-25, the staff asked the applicant to provide its basis for why the analysis has not been identified as a TLAA for the LRA and evaluated (with justification) in accordance with 10 CFR 54.21(c), and why the generic core plate rim hold-down analysis in BWRVIP-25 is considered to be bounding and acceptable for the design and loadings of the core plate assembly at Fermi 2.

In RAI 4.1-2, Part (c), the staff requested the applicant to explain why Option (b) of LRA Commitment No. 7, Part c, does not state that the loss of preload/stress relaxation analysis will be submitted for NRC approval (i.e., if the analysis has not already been demonstrated to be applicable to the bolt design at Fermi 2 and approved by the staff).

By letter dated February 5, 2015, the applicant responded to RAI 4.1-2, Parts (a), (b), and (c). In its response to RAI 4.1-2, Part (a), the applicant stated that the specific analysis referred to in Commitment No. 7 will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The applicant also provided the following responses to RAI 4.1-2, Parts (b) and (c):

(b) The BWRVIP is developing justification for the elimination of core plate bolt inspections for plants without installed core plate wedges. This new evaluation is different than the generic analysis evaluated in BWRVIP-25 and approved in the NRC SE of December 7, 2000. While this new evaluation will also be generic (applicable to multiple plants), each site will have to meet criteria dependent on plant-specific load combinations and peak fluence at the core plate bolt locations. Like the analysis evaluated in BWRVIP-25, the new core plate bolt evaluation will address loss of preload/stress relaxation through the period of extended operation.

(c) The new evaluation described above will be performed when instructed by the BWRVIP through incorporation into an existing BWRVIP Inspection & Evaluation Guideline. The evaluation will be performed under the provisions of BWRVIP implementation guidelines in BWRVIP-94, Revision 2, which also provides for NRC notification and submittal as appropriate. Therefore, notification and submittal to the NRC will be performed in accordance with BWRVIP-94, Revision 2.

    If Option 2 of Commitment No. 7 is performed and the analysis results in acceptance criteria for continued inspection, then the inspection plan, along with the acceptance criteria and justification for the inspection plan, will be submitted to the NRC two years prior to the period of extended operation.

The applicant amended LRA AMP B.1.10, "BWR Vessel Internals"; LRA UFSAR Supplement Section A.1.10, "BWR Vessel Internals"; Commitment No. 7 in LRA UFSAR Supplement Table A.4; and the response to AAI No. 4 on BWRVIP-25, as given in LRA Appendix C, to be consistent with the amended basis provided in the responses to RAI 4.1-2, Parts (a), (b), and (c).

The staff noted that, based on the responses to RAI, 4.1-2, Parts (a), (b), and (c), there is no analysis contained or incorporated by reference in the CLB related to the stress relaxation of the core plate rim hold-down bolts at Fermi 2, and therefore this is not a TLAA.

The adequacy of the applicant's plans for aging management of the core plate rim hold-down bolts is evaluated in SER Section 3.0.3.2.3.

AAI No. 4 on BWRVIP-26-A (BWRVIP I&FE Guidelines for BWR Top Guide Assemblies). In the staff's SE on BWRVIP-26-A, dated December 7, 2000 (ADAMS Accession No. ML003776110), the staff issued AAI No. 4, requesting BWR applicants to identify any plant-specific TLAAs that may be applicable to the evaluation of BWR top guide components. Specifically, in this AAI, the staff stated that BWR applicants for license renewal should identify and evaluate the impact of accumulated neutron fluence on the potential to initiate irradiation assisted stress corrosion cracking (IASCC) in BWR top guide components and should evaluate the basis for identifying this evaluation as a TLAA for the top guide components.

In its response to this AAI, the applicant stated that the 60-year projected fluence for the Fermi 2 top guide exceeds the threshold for the initiation of the IASCC-induced cracking in the top guide and its subcomponents. However, the applicant stated that the methodology in BWRVIP-26-A does not include any analysis that would constitute a TLAA for Fermi 2 since the report was not used to make any safety determination or as justification for reducing the number of inspections that would be applied to these components. The applicant stated that, since Fermi 2 has implemented the inspection requirements of BWRVIP-26-A and BWRVIP-183, the BWR Vessel Internals Program will be adequate to manage the effects of aging of the top guide assembly for the period of extended operation.

The staff noted that, in BWRVIP-26-A report, Appendix B, the EPRI BWRVIP included a generic flaw analysis for postulated cracks in BWR top guide grid beam components. The staff noted that this flaw analysis uses a proprietary upper bound fluence value as the basis for establishing the critical stress intensity value for BWR top guide components in the industry. Therefore, it was not evident to the staff why the time-dependent flaw evaluation in BWRVIP-26-A had not been identified as a TLAA, particularly if the applicant was relying on the analysis to justify the augmented inspection methods and frequencies that will be applied to the top guide assembly during the period of extended operation.

By letter dated December 23, 2014, the staff issued RAI 4.1-3, requesting that the applicant clarify whether the flaw evaluation for BWR top guide grid beam locations in BWRVIP-26-A, Appendix B, is relied upon to justify the augmented inspection methods and frequencies for the top guide grid beam locations at Fermi 2. If so, the staff asked the applicant to provide justification for: (a) why the flaw evaluation in BWRVIP-26-A was not considered to be part of the safety basis decision for implementing the BWRVIP-26-A guidelines as part of the BWR Vessel Internals Program and (b) why the generic flaw evaluation in BWRVIP-26-A, Appendix B, had not been identified as a TLAA for the LRA, when compared to the six criteria for TLAAs in 10 CFR 54.3(a).

By letter dated February 5, 2015, the applicant provided its response to RAI 4.1-3. In its response, the applicant stated that BWRVIP-26-A, Appendix B, only provides a sample flaw evaluation for selected BWR top guide grid beam locations. The applicant also clarified that, since the evaluation is not a component-specific evaluation, the sample flaw evaluation in BWRVIP-26-A is not relied upon to justify the validity of augmented inspections that will be applied to the top guide assembly during the period of extended operation. The staff noted that the applicant's response to RAI 4.1-3 provides a valid basis for concluding that the flaw evaluation in BWRVIP-26-A is not part of the CLB for Fermi 2. Based on this response, the staff finds that the flaw evaluation in the BWRVIP-26-A report does not need to be identified as a TLAA for the LRA because (a) the analysis is not contained or incorporated by reference in the CLB and (b) therefore, the analysis does not conform to Criterion 6 in 10 CFR 54.3(a). The staff's concerns associated with RAI 4.1-3 and AAI No. 4 on BWRVIP-26-A are resolved with respect to this TLAA identification matter.

Based on this review, the staff concludes that AAI No. 4 on BWRVIP-26-A does not include a TLAA applicable to the applicant.

AAI No. 4 on BWRVIP-27-A (BWRVIP I&FE Guidelines for Standby Liquid Control Nozzles). In the staff's SE on BWRVIP-27-A, dated December 20, 1999 (ADAMS Accession Nos. ML993630179 and ML993630186), the staff issued AAI No. 4, requesting BWR applicants to address those plant-specific TLAAs that may be applicable to the evaluation of BWR SLC/core ΔP nozzle components. Specifically, in this AAI (AAI No. 4 on BWRVIP-27-A), the staff stated that, due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27-A report for license renewal should identify and evaluate the projected fatigue CUFs as a potential TLAA issue.

In its response to this AAI, the applicant stated that the BWRVIP-27-A fatigue analysis of the SLC/core ΔP line for 60 years of operation is a TLAA. The applicant stated that the NRC SE on BWRVIP-27-A calls for each BWR applicant to address the projected CUF but recognizes that this fatigue analysis is not required for all SLC/core ΔP configurations. The applicant stated that at Fermi 2, the SLC/core ΔP lines inside the reactor RPV are not subject to an aging management review (AMR).

The staff noted that the applicant's response to AAI No. 4 on BWRVIP-27-A identifies that the CLB includes a metal fatigue TLAA (i.e., CUF analysis) for the SLC/core ΔP nozzle to the RPV. The staff confirmed that the LRA includes a CUF assessment for the SLC/core ΔP nozzle in LRA Section 4.3.1.1. The staff evaluation of the CUF analysis for SLC/core ΔP nozzle is documented in SER Section 4.3.1.1.

The staff noted that UFSAR Section 4.5.2.4.3 states that the SLC system is needed to remain operational to comply with the requirements in 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," as referenced in 10 CFR 54.4(a)(3). The staff also noted that UFSAR Section 4.5.1.2.11 states that portions of the SLC/core ΔP line internal to the RPV are needed to facilitate good mixing and dispersion of the system boron contents into the RPV when SLC is activated and to reduce thermal shock to the RPV's SLC/core ΔP nozzle should SLC be activated. Thus, it is not clear to the staff why the portions of the SLC lines internal to the RPV would not need to be included in the scope of license renewal in accordance with either one of the following requirements in 10 CFR 54.4, "Scope":

- 10 CFR 54.4(a)(2) – in that the failure of the SLC line inside the RPV would no longer be capable of mitigating a thermal shock impact to the RPV's SLC/core ΔP nozzle (an RCPB component) during a postulated design basis loss of coolant accident (LOCA)

- 10 CFR 54.4(a)(3) – in that the failure of the SLC line inside the RPV could impact the ability of SLC to properly mix and disperse boron-10 inside of the reactor if SLC is called upon to actuate during a postulated design basis accident

The staff also noted that the applicant's response to AAI No. 4 on BWRVIP-27-A did not provide sufficient demonstration that the CLB did not include a metal fatigue analysis (i.e., CUF analysis) or other type of cycle loading analysis for the portions of the SLC/core ΔP line internal to the RPV (i.e., not inclusive of the SLC/core ΔP nozzle adjoined to the RPV).

By letter dated December 23, 2014, the staff issued RAI 4.1-4, requesting that the applicant provide further clarification on these matters. Specifically, in Part (a) of RAI 4.1-4, the staff requested the applicant to justify why the portions of the SLC and core ΔP line internal to the RPV have not been identified as within the scope of license renewal. Specifically, the staff requested the applicant to indicate whether these components are required to be within the scope of license renewal in accordance with 10 CFR 54.4(a). If these components are within the scope of license renewal, the staff asked the applicant to provide the basis as to why the portions of the SLC and core ΔP line internal to the RPV had not been subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff also asked the applicant to amend the LRA accordingly if it is determined that these components are subject to an AMR.

In RAI 4.1-4, Part (b), the staff requested the applicant to identify the design code or design analyses of record that was used for the portions of the SLC and core ΔP line that are located internal to the RPV (i.e., not inclusive of the SLC and core ΔP nozzle adjoined to the RPV). The staff also asked the applicant to clarify whether the design code or design analyses of record included a metal fatigue analysis or other type of cyclical loading analysis (e.g., cycle-based expansion stress or maximum allowable stress range reduction analysis or a fatigue waiver analysis) for the portions of the SLC and core ΔP line internal to the RPV. If so, the staff asked the applicant to explain why the analysis would not need to be identified and evaluated as a TLAA for the LRA, when compared to the six criteria for TLAAs in 10 CFR 54.3(a).

By letter dated February 5, 2015, the applicant responded to RAI 4.1-4, Parts (a) and (b). In its response to RAI 4.1-4, Part (a), the applicant stated that the internal portions of the core ΔP line only serve a diagnostic function for measuring differential pressure across the reactor internal core plate and does not serve a license renewal intended function. The applicant stated that, although the UFSAR indicates that the internal portions of the SLC line are needed to facilitate good mixing, the BWRVIP-27-A report concludes that the boron need only reach the bottom head and there is sufficient natural circulation to distribute boron uniformly through the core. Therefore, the applicant stated that distribution of liquid by the SLC and core ΔP line is not essential and the portions of the SLC/core ΔP line internal to the RPV do not perform a license renewal intended function.

The staff noted that the applicant's response to RAI 4.1-4, Part (a), did not provide the staff with sufficient demonstration that the internal portions of the SLC/core ΔP line are not within the scope of license renewal in accordance with 10 CFR 54.4(a). Based on the staff's review of UFSAR Sections 4.5.1.2.11 and 4.5.2.4.1, the staff concluded that the internal portions of the SLC/core ΔP line should be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2), where its failure could potentially impact the ability to achieve its RCPB function or 10 CFR 54.4(a)(3) for mitigating the consequences of anticipated transients without scram events.

By letter dated May 20, 2015, the staff issued followup RAI 4.1-4a, Parts a and b, to address the applicant's scoping and screening bases for the internal portions of the SLC/core ΔP line. The staff also issued followup RAI 4.1-4a, Part c, to address whether the applicant would need to perform an AMR of the internal portions of the SLC/core ΔP line in accordance with 10 CFR 54.21(a)(1), and whether there are any aging effects that would need to be managed in these lines.

The applicant responded to RAI 4.1-4a, by letter dated July 6, 2015, and provided a supplemental response to RAI 4.1-4a, by letter dated August 20, 2015. The latter stated that Fermi 2 will conservatively assume that the SLC/core ΔP line internal to the reactor vessel performs a license renewal intended function per 10 CFR 54.4(a)(3), such that this line will facilitate adequate boron mixing to shut down the core during an anticipated transient without scram event. In its responses, the applicant further provided the aging management activities to ensure that loss of material and cracking of the internal portions of the SLC/core ΔP line will be adequately managed for the period of extended operation. Therefore, the staff finds the applicant's response to RAI 4.1-4, Part (a) and RAI 4.1-4a acceptable. The staff's full evaluation and resolution of concerns of the applicant's response to followup RAI 4.1-4a, Parts a and b, is documented in SER Section 2.3.3.2. The staff's evaluation and resolution of concerns of the applicant's response to followup RAI 4.1-4a, Part c, is documented in SER Section 3.0.3.2.3.

In its response letter to RAI 4.1-4, Part (b), dated February 5, 2015, the applicant provided a proprietary response that (a) summarized the vibrational loading analysis for the internal portions of the SLC/core ΔP line and (b) provided the applicant's basis for concluding that the vibrational loading analysis would not need to be identified as a TLAA for the LRA. The applicant stated that both an ASME Code Section III stress analysis and a vibrational loading analysis were applied to the internal portions of the SLC line. The applicant also stated that the ASME stress analysis only involved a stress analysis for these lines. The applicant also stated that the vibrational loading analysis for the internal portions of the SLC/core ΔP line did not involve stresses sufficient to initiate fatigue in the components.

The staff confirmed that, consistent with information in the Fermi 2 UFSAR, the ASME analysis only involved a stress analysis for the SLC lines and that the SLC lines were not procured and analyzed to a design code (e.g., ASME Code Section III or American National Standards Institute (ANSI) B31.1) that would have required a CUF or implicit fatigue analysis of the lines. The staff also confirmed that the vibrational stress loads for the SLC/core ΔP line (as cited in the applicant's proprietary response to RAI 4.1-4) were lower than those assessed for fatigue in the ASME Code Section III. Therefore, based on its review, the staff concludes that the applicant has provided sufficient demonstration that there are no cyclical loading-related TLAAs for the internal portions of the SLC/core ΔP line because the staff has confirmed that: (a) the design basis does not include a metal fatigue analysis for internal portions of these lines, and (b) the magnitude of the stresses in the vibrational loading analysis are below the threshold for time dependence. The staff's concerns described in RAI 4.1-4, Part (b), and applicant/licensee action item (A/LAI) No. 4 on BWRVIP-27-A are resolved.

AAI No. 4 on BWRVIP-42 (I&FE Guidelines for Low-Pressure Coolant Injection Couplings). In the staff's SE on BWRVIP-42-A, dated January 9, 2001 (ADAMS Accession No. ML010100157), the staff issued AAI No. 4, requesting BWR applicants to address those plant-specific TLAAs that may be applicable to the evaluation of BWR LPCI coupling components.

The staff reviewed BWRVIP-42-A and confirmed that the scope of the report is not applicable to the design of the LPCI lines at Fermi 2. Therefore, based on its review, the staff concludes that the LRA does not need to include a response to AAI No. 4 on BWRVIP-42-A because the staff has confirmed that the I&FE guidelines in the report do not apply to the design of the LPCI lines at Fermi 2.

AAI No. 4 on BWRVIP-47-A (I&E Guidelines for BWR Lower Plenum Components). In the staff's SE on BWRVIP-47-A, dated December 7, 2000 (ADAMS Accession No. ML003775765), the staff issued AAI No. 4, requesting BWR applicants to address those plant-specific TLAAs that may be applicable to the evaluation of BWR lower plenum components. Specifically, in this AAI (AAI No. 4 on BWRVIP-47-A), the staff stated that, due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for license renewal should identify and evaluate the projected CUF as a potential TLAA issue.

In its response to this AAI, the applicant stated that the BWRVIP-47-A identified fatigue analyses of lower plenum pressure boundary components as potential TLAAs. The applicant stated that the CLB includes metal fatigue evaluations (calculated CUF) for selected RPV lower plenum components. The applicant stated that the metal fatigue evaluations qualify as TLAAs for the LRA. The applicant stated that the metal fatigue TLAAs for the lower plenum components are identified and evaluated in LRA Section 4.3.1.4.

The staff reviewed LRA Chapter 4 and verified that Section 4.3.1.4 identifies the CUF analyses for the following RPV lower plenum component locations: (a) access hole cover – ring-to-cover location, (b) access hole cover – ring-to-adapter ring location, and (c) access hole cover – adapter ring-to-shroud support location.

Based on its review, the staff finds the applicant's response to this AAI acceptable because the staff has confirmed that the applicant has included applicable fatigue TLAAs for the three access hole cover locations in the LRA and that the design basis does not include any other analysis that needs to be identified as a TLAA for RPV lower plenum area components. The staff's evaluation of the metal fatigue TLAAs for the RPV lower plenum component locations is documented in SER Section 4.3.1.4.2.

AAI Nos. 8 – 13 on BWRVIP-74-A (I&E Guidelines for BWR Reactor Pressure Vessel Components). In the staff's SE on BWRVIP-74-A, dated June 30, 2003 (ADAMS Accession No. ML031710349), the staff issued AAI Nos. 8 – 13, which relate to the need for identification of the following TLAAs or assessments related to the RCPB function of BWR RPVs:

- AAI No. 8 on the need to identify metal fatigue TLAAs (CUF analyses) for RPV components that are part of the RCPB
- AAI No. 9 on the need to identify applicable pressure-temperature (P-T) limit TLAAs for the RPV
- AAI No. 10 on the need to identify applicable upper-shelf energy (USE) TLAAs for the RPV
- AAI Nos. 11 and 12 on the need to identify applicable mean reference nil-ductility transition temperature (RT_{NDT}) and probability of failure TLAAs for RPV circumferential and axial weld components if the methodology in TR No. BWRVIP-05 was used to request relief from augmented inspection requirements for RPV circumferential welds in

10 CFR 50.55a(g) and relief was granted in accordance with 10 CFR 50.55a(a)(3) requirements for the current operating period

- AAI No. 13 on the need to perform 60-year neutron fluence values assessments for the RPV components, as inputs to the TLAAs identified in AAI Nos. 8 – 12

The staff noted that the applicant included its response to these AAIs in LRA Appendix C. The staff also confirmed that the applicant has included all of these assessments as appropriate TLAAs for the LRA, as given in the following LRA sections:

- LRA Section 4.2.1, which provides the 60-year neutron fluence evaluation and TLAA for components in the beltline and extended beltline of the RPV
- LRA Sections 4.2.2 and 4.2.3 for the adjusted reference temperature (ART) and P-T TLAAs that are needed to ensure that appropriate P-T limits are developed for the period of extended operation
- LRA Section 4.2.4 for the TLAA on USE
- LRA Sections 4.2.5 and 4.2.6 for the mean RT_{NDT} and conditional probability of failure analyses of the RPV circumferential and axial weld components
- LRA Section 4.3.1.1 for the metal fatigue TLAAs for RPV components, LRA Section 4.3.1.2 for the metal fatigue TLAA for the RPV feedwater nozzles, and LRA Section 4.3.3 for the effects of reactor water environment on metal fatigue life

Based on its review, the staff finds the applicant has addressed and resolved the requests in AAI Nos. 8 – 13 on the BWRVIP-74-A report because the applicant has included the applicable TLAAs in the LRA. The staff's evaluation of the neutron fluence TLAA for the RPV is given in SER Section 4.2.1. The staff's evaluation of the TLAA on the ART calculations for the RPV components is documented in SER Section 4.2.2. The staff's evaluation of the TLAA for the RPV P-T limits is documented in SER Section 4.2.3. The staff's evaluation of the TLAA on RPV USE is documented in SER Section 4.2.4. The staff's evaluations of the TLAAs on the mean ART (mean RT_{NDT}) and conditional probability of failure analyses for the RPV circumferential and axial welds components are documented in SER Sections 4.2.5 and 4.2.6. AAI Nos. 8 – 13 on the BWRVIP-74-A report are resolved.

AAI No. 6 on BWRVIP-76 Revision 1-A (I&FE Guidelines for BWR Core Shrouds). In the staff's SE on BWRVIP-76-A, dated December 31, 2009 (ADAMS Accession No. ML101530467), which also applies to BWRVIP-76 Revision 1-A (ADAMS Accession No. ML15266A192), the staff issued AAI No. 6, requesting BWR applicants to address those AMPs and plant-specific TLAAs that may be applicable to the evaluation of BWR core shroud components. Specifically, in this AAI (AAI No. 6 on BWRVIP-76-A), the staff noted that the guidance in Table IV.B1 of the GALL Report lists two potentially applicable aging effects (i.e., in addition to cracking) for generic BWR RVI components (including BWR core shroud and core shroud repair assembly components) that are made from either stainless steel (including cast austenitic stainless steel) or nickel alloy: (1) loss of material due to pitting and crevice corrosion (GALL Report AMR IV.B1-15) and (2) cumulative fatigue damage (GALL Report AMR IV.B1-14). In AAI No. 6 on BWRVIP-76-A, the staff requested that BWR license renewal applicants address the bases for managing cumulative fatigue damage and loss of materials due to pitting and crevice corrosion of their core shroud components:

> BWR [license renewal] applicants will need to assess their designs to see if the generic guidelines for managing cumulative fatigue damage in GALL AMR item IV.B1-14 and for managing loss of material due to pitting and crevice corrosion in GALL AMR IV.B1-15 are applicable to the design of their core shroud components (including welds) and any core shroud repair assembly components that have been installed through a design modification of the plant. If these aging effects are applicable to the design of these components as a result of exposing them to a reactor coolant with integrated neutron flux environment, applicants for license renewal will need to: (1) identify the aging effects as aging effects requiring management (AERM) for the core shrouds and for their core shroud repair assembly components if a repair design modification has been implemented, and (2) identify the specific aging management programs or time-limited aging analyses that will be used to manage these aging effects during the period of extended operation.

In its response to this AAI, the applicant stated that the core shroud is fabricated from stainless steel Type 304L and that the aging effects of loss of material and cumulative fatigue damage have been identified for the core shroud. The applicant stated that the BWR Vessel Internals Program and the Water Chemistry Control – BWR Program have been credited to manage loss of material due to pitting and crevice corrosion in the core shroud during the period of extended operation. The applicant also stated that it has not detected any cracking of vertical (axial) or horizontal (circumferential) weld seams in the core shroud and therefore has not implemented a repair design modification for the shroud. The applicant stated that the metal fatigue TLAAs for the RVI components are evaluated in LRA Section 4.3.1.4.

The staff confirmed that aging management of the core shroud in accordance with BWRVIP-76-A is within the scope of the applicant's BWR Vessel Internals Program. The staff's evaluation of the BWR Vessel Internals Program is documented in SER Section 3.0.3.2.3. The staff noted that the applicant stated that the evaluation of the metal fatigue TLAAs for the RVI components are in LRA Section 4.3.1.4; however, the staff also noted that LRA Section 4.3.1.4 did not indicate which design code or specification was used for the design and fabrication of the core shroud or whether the design code or specification required a metal fatigue analysis or other type of cyclical loading analysis for the core shroud.

By letter dated December 23, 2014, the staff issued RAI 4.1-5, requesting that the applicant identify the design code or design specification of record that was used for the design and fabrication of the core shroud. The staff also requested the applicant to clarify whether the design code or design specification of record required the applicant to perform a metal fatigue analysis or other type of cyclical loading analysis (e.g., cycle-based expansion stress or maximum allowable stress range reduction analysis or a fatigue waiver analysis) for the core shroud. If so, the staff requested the applicant to provide justification as to why the analysis would not need to be identified as a TLAA for the LRA, when compared to the six criteria for TLAAs in 10 CFR 54.3(a).

By letter dated February 5, 2015, the applicant responded to RAI 4.1-5. The applicant's response stated that, for BWR-4 plants such as Fermi 2, the core shroud was not designed to either ASME Code III or other design specification requirements. The applicant stated that the design and construction of the shroud only used the ASME design code as a general guideline for fabricating the core shroud, using welders and techniques qualified in accordance with ASME Code Section IX. The applicant stated that, as discussed in LRA Sections 3.1.2.2.1 and 4.3.1.4, the RVIs and core support structure (including the shroud) are not part of the RCPB.

Based on these factors, the applicant stated that the design bases for the design and fabrication of the core shroud did not require a fatigue analysis of the shroud as part of the CLB for the facility.

The staff reviewed the applicant's response and basis against the relevant design information provided in the UFSAR. The staff noted that the UFSAR does not identify that either ASME Code Section III or any another design code or specification was used for the design or fabrication of the core shroud. Therefore, the staff determined that the applicant has provided an acceptable basis for concluding that the design of the core shroud did not require the applicant to perform a fatigue analysis for the shroud because: (a) the staff confirmed that the core shroud was not designed in accordance with any design code or specification that otherwise, if used for the CLB, might have required the performance of a fatigue analysis as part of the CLB, and (b) this provides sufficient demonstration that the CLB does not include any fatigue analyses for the core shroud that would need to be identified as TLAAs for the LRA. The staff's concerns described in RAI 4.1-5 are resolved.

4.1.2.2 Identification of Exemptions

As required by 10 CFR 54.21(c)(2), the applicant must identify all exemptions that were granted in accordance with the exemption approval criteria in 10 CFR 50.12 and are based on a TLAA. For those exemptions that meet these criteria, the rule requires the applicant to evaluate the exemptions and justify their use during the period of extended operation.

In LRA Section 4.1.2, the applicant stated that it performed a search in accordance with the exemption approval criteria in 10 CFR 50.12 to find any exemptions that were granted for the Fermi 2 CLB and were based on a TLAA. The applicant stated it performed its search based on a review of relevant licensing basis or design basis information in the UFSAR, ASME Code Section XI Program documentation, fire protection documents, operating license, TS and docketed correspondence. The applicant stated that it did not find any exemptions that were based on a TLAA and will remain in effect for the period of extended operation.

The staff also reviewed the applicant's CLB to see if it included any exemptions based on a TLAA that were granted in accordance with 10 CFR 50.12. The staff's review included a review of the current operating license and TS for the facility and the applicant's UFSAR. The staff's review also included a search of the NRC's main and legacy libraries in the NRC's ADAMS Document Control Library using the keyword "exemption."

The staff noted that 10 CFR 54.21(c)(2) requires the applicant to identify a particular exemption as part of the LRA if the exemption was granted in accordance with the requirements of 10 CFR 50.12 and based on a TLAA. For exemptions that meet these criteria, the requirements in 10 CFR 54.21(c)(2) apply regardless of whether the exemptions will remain in effect for the period of extended operation. Therefore, the staff noted that LRA Section 4.1.2 may have omitted exemptions that were granted in accordance with 10 CFR 50.12 and are based on a TLAA, but will not remain in effect for the period of extended operation. The staff noted that any such omissions would not be in compliance with the requirements of 10 CFR 54.21(c)(2).

By letter dated December 23, 2014, the staff issued RAI 4.1-6 requesting that the applicant identify all exemptions that were granted in accordance with 10 CFR 50.12 and are based on a TLAA, but will not remain in effect for the period of extended operation.

By letter dated February 5, 2015, the applicant responded to RAI 4.1-6. In its response, the applicant stated that the CLB does not include any exemptions that were granted in accordance with 10 CFR 50.12 and that are based on a TLAA that are currently in effect, but will not remain in effect for the period of extended operation. The staff's review of this RAI response is discussed in conjunction with that for RAI 4.1-7.

The staff noted that UFSAR Section 6.2 states that the NRC granted a number of exemptions from meeting the requirements of 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, for the containment leak rate testing program. However, the UFSAR does not describe what these exemptions involved or whether the alternative testing requirements or exceptions authorized by the exemptions were based on or supported by a time-dependent analysis. Therefore, the staff determined that additional information would be needed to determine whether these exemptions were previously granted in accordance with 10 CFR 50.12 and are based on a TLAA.

By letter dated December 23, 2014, the staff issued RAI 4.1-7, requesting that the applicant describe each exemption that was granted in accordance with 10 CFR 50.12 from meeting the 10 CFR Part 50, Appendix J, leak rate testing requirements. The staff requested the applicant to explain whether the exemptions were based on or supported by a time-dependent analysis, calculation, or evaluation that conforms to the six criteria for TLAAs in 10 CFR 54.3(a). If it is determined that a specific 10 CFR Part 50, Appendix J, leak rate testing exemption was granted under 10 CFR 50.12 and is based on a TLAA, the staff asked the applicant to amend the LRA to identify and evaluate the exemption in accordance with the requirement in 10 CFR 54.21(c)(2).

By letter dated February 5, 2015, the applicant responded to RAI 4.1-7. In its response, the applicant identified that the following exemptions from the requirements of 10 CFR Part 50, Appendix J, were granted for the CLB in accordance with the requirements of 10 CFR 50.12:

- An alternative leak rate testing basis for the main steam isolation valves (MSIVs) in lieu of the typical Type C local leak rate testing requirements for these valves in 10 CFR Part 50, Appendix J. For this exemption, the applicant explained that the MSIVs have separate leakage limits, and the dose consequence of this leakage path is evaluated separately and added to those calculated from Primary containment "La" leakage requirements specified in the 10 CFR Part 50, Appendix J, rule. The applicant explained that, as such, this leakage is not combined with the Type B and C leakage rate totals. The applicant stated that this exemption is not based on a TLAA.
- An alternate testing of the air lock, which consisted of testing the seals of the inner and outer doors at the "P_a" pressure rather than testing the entire air lock, after the opening of the doors. The applicant stated this exemption was not based on a time-limited analysis and it is no longer in effect because it was deleted from the CLB in License Amendment No. 108.
- An exemption that reclassified the inboard containment LPCI valve configuration as an alternate definition for a containment isolation valve, such that Type C testing is no longer required for the LPCI valve. This reclassification was approved in License Amendment 98 and Exemption to the Facility Operation License No. NPF-43 Fermi 2. The applicant stated that the exemption permits the applicant to use an alternate testing method for the LPCI valves and explained that the LPCI penetrations X-13A & B were designed and built to General Design Criteria 55, which required both an inboard and outboard isolation capability. The applicant stated that the exemption took exception to the Type C testing requirements based on identification of two alternative barriers, which

included the residual heat removal system being a closed loop outside of primary containment and that penetrations (X-13A & B) will remain water sealed during a loss-of-coolant accident. The applicant stated that this exemption is not based on a TLAA.

- An exemption that proposed an alternate technique to the mass plot method for analyzing Type A test data had been approved. The applicant stated that the "need for this exemption was eliminated when the Primary Containment Leakage Testing Program was implemented per 10 CFR Part 50, Appendix J, Option B, based on NEI 94-01 and RG 1.163, as approved in License Amendment 108." The applicant stated this exemption was not based on a time-limited analysis and it is no longer in effect because it was deleted from the CLB in License Amendment No. 108.
- Two one-time schedule exemptions from 10 CFR Part 50, Appendix J, leak rate testing requirements had been issued and expired. The applicant stated that these scheduler exemptions were not based on a TLAA.

The staff noted that the six exemptions granted from the requirements in 10 CFR Part 50, Appendix J, involved either alternative testing bases, alternative test data analysis bases, or alternative test implementation schedule bases. The staff also noted that the exemption requests for these alternatives were not predicated on any analysis qualifying as a TLAA. Therefore, based on its review, the staff finds that these exemptions do not meet the criteria for exemption identification in 10 CFR 54.21(c)(2) because the staff has confirmed that the exemptions are not based on a TLAA.

Based on its review of the applicant's responses to RAI 4.1-6 and 4.1-7, the staff confirms that the applicant has provided ample demonstration that the CLB does not include any exemptions granted under 10 CFR 50.12 that are based on a TLAA, regardless of whether the exemptions will be relied upon for the period of extended operation. The staff's concerns described in RAI 4.1-6 and 4.1-7 are resolved. The staff finds that there are not any other exemptions that were granted from 10 CFR Part 50 requirements in accordance with 10 CFR 50.12 and that are based on a TLAA.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff concludes, as required by 10 CFR 54.21(c)(2), that no exemption, pursuant to 10 CFR 50.12, based on a TLAA had been granted.

4.2 Reactor Vessel 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 TLAA for reactor vessel neutron fluence. The applicant stated that the reactor vessel neutron fluence was calculated using a higher power level, beginning with cycle 17 when the reactor power increased due to the measurement uncertainty recapture/thermal power optimization (MUR/TPO) update.

The LRA also states that the peak neutron fluence projected for 52 effective full-power years (EFPY) is 1.43×10^{18} n/cm^2 at the vessel inner surface. In addition, the one-quarter thickness (1/4T) peak fluence values (E > 1 MeV) for 52 EFPY are as follows: 9.90×10^{17} n/cm^2 for lower-intermediate shell plates and axial welds; 2.47×10^{17} n/cm^2 for water level instrumentation nozzle; and 6.51×10^{17} n/cm^2 for lower shell plates and axial welds, and lower to lower-intermediate girth weld. The reactor vessel neutron fluence was determined using the General Electric-Hitachi (GEH) method for neutron fluence calculation found in the staff-approved topical NEDO-32983-A, "General Electric Methodology for RPV Fast Neutron Flux Evaluations," Revision 2, dated January 31, 2006 (ADAMS Accession No. ML072480121). The LRA states that this method adheres to the guidance prescribed in RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," dated March 2001 (ADAMS Accession No. ML010890301). The neutron fluence calculation results are inputs into the other reactor vessel neutron embrittlement TLAAs, such as analyses for ARTs and P-T limits.

The applicant dispositioned the TLAA for reactor vessel neutron fluence in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor vessel and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.2.3.1 (e.g., SRP-LR Sections 4.2.3.1.1.1, 4.2.3.1.2.1, and 4.2.3.1.3.1), which state 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 RG 1.190.

The staff noted that the applicant provided 52-EFPY fluence values, which cover the period of extended operation. The staff also noted that the applicant used the staff-approved GEH methodology. The staff further noted that the fluence calculation uncertainty analysis and qualification of the applicant's methodology adhere to the guidance contained in RG 1.190. In addition, the staff's acceptance of the GEH methodology is described in the SE, dated November 17, 2005, for NEDO-32982P-A.

The staff noted that LRA Section 4.2.1 states that the peak reactor vessel wall neutron fluence projected for 52 EFPY is 1.43×10^{18} n/cm^2 (E > 1 MeV), considering the implemented MUR/TPO. In comparison, the staff noted that UFSAR Section 4.3.2.8.2, "Extended Power Uprate Analysis," indicates that a reactor vessel fluence evaluation was performed in support of an extended power uprate (EPU) to 120 percent of the original licensed power. The staff also noted that UFSAR Table 4.3-2 describes both pre-EPU and EPU fluence values for 32 EFPY (i.e., original license term of 40 years).

The LRA does not clearly address whether the fluence calculations are based on the operating conditions of the potential EPU described in UFSAR Section 4.3.2.8.2. By letter dated December 4, 2014, the staff issued RAI 4.2.1-1 requesting that the applicant clarify whether the neutron fluence described in the LRA are based on the operating conditions of the potential EPU described in UFSAR Section 4.3.2.8.2. The staff also requested that the applicant clarify the operating power levels on which the neutron fluence calculations are based.

By letter dated January 5, 2015, the applicant provided its response to RAI 4.2.1-1. In its response, the applicant clarified that the neutron fluence projections in the LRA are not based on the use of EPU power projections, because the EPU was never pursued. The applicant also clarified that the staff approved an MUR/TPO power increase of Fermi 2 from 3,430 megawatts thermal (MWt) to 3,486 MWt beginning in cycle 17 by letter dated February 10, 2014 (ADAMS Accession No. ML13364A131). The applicant further clarified that the operating power levels used to determine the 52-EFPY fluence are based on either 3,292 MWt or 3,430 MWt for operating cycles through cycle 16 and 3,486 MWt for operating cycles beginning with cycle 17 and continuing through the period of extended operation, which is consistent with the staff approval for the MUR/TPO.

The staff finds the applicant's response acceptable because the applicant provided clarification of the operating power levels used to determine the neutron fluence projections, and these power levels are consistent with the plant's CLB. The staff's concern described in RAI 4.2.1-1 is resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii) that the analysis for the reactor vessel fluence has been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.2 because (1) the fluence evaluation was performed in accordance with NRC-approved RG 1.190-adherent methodology and (2) the applicant provided 52-EFPY fluence values, which cover the period of extended operation.

4.2.1.3 UFSAR Supplement

LRA Section A.2.1.1 provides the UFSAR supplement summarizing the TLAA on the reactor vessel neutron fluence. The staff reviewed LRA Section A.2.1.1 consistent with the review procedures in SRP-LR Section 4.2, which state that the applicant should provide a summary description of the evaluation of the reactor vessel neutron embrittlement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.2.2.2, and is therefore acceptable. Additionally, the staff determines 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 have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required per 10 CFR 54.21(d).

4.2.2 Adjusted Reference Temperatures (ARTs)

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 describes the applicant's TLAA on the ARTs for reactor vessel components. The LRA states that a key parameter that characterizes the fracture toughness of a reactor vessel material is the material reference temperature, which for the unirradiated condition is the RT_{NDT} value. As neutron irradiation of the material increases, the material reference temperature RT_{NDT} increases and the embrittlement effects of neutron irradiation are reflected in the change (increase) in the reference temperature (ΔRT_{NDT}). The adjusted reference temperature or ART is calculated by adding ΔRT_{NDT} to the initial unirradiated RT_{NDT} along with a margin term to account for uncertainties (M), in accordance with RG 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2, dated May 1988 (ADAMS Accession No. ML003740284). The LRA also states that the reactor vessel plate and weld materials included in the BWRVIP Integrated Surveillance Program (ISP) were evaluated to determine 52-EFPY ARTs in accordance with RG 1.99, Position 2.1 (surveillance data available). The ART values of all other reactor vessel beltline materials were determined in accordance with RG 1.99 Position 1.1 (surveillance data not available). In addition, the method used to evaluate the 52-EFPY ARTs for 60 years of operation is the same as the method used by GEH in the Fermi 2 license amendment request for MUR/TPO uprate, as approved by letter dated February 10, 2014 (ADAMS Accession No. ML13364A131). The LRA states that the GEH method used to evaluate the neutron fluence values used in this TLAA adheres to the guidance provided in RG 1.190. The ARTs are used in the evaluation of the P-T limits as required by 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements."

The applicant dispositioned the TLAA for the reactor vessel in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed the applicant's ART TLAA for the reactor vessel components and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the documented results of the revised analyses are reviewed to verify that their period of evaluation is extended such that they are valid for the period of extended operation. SRP-LR Section 4.7.3.1.2 also states that the applicable analysis technique can be the one in effect in the plant's CLB at the time of filing of the renewal application.

In its review, the staff noted that LRA Table 4.2-2 describes the 52-EFPY ART values of the reactor vessel beltline materials and other related data (e.g., material chemistry, chemistry factor, 52-EFPY fluence, initial RT_{NDT}, and ΔRT_{NDT}). The staff also noted that the ART values in LRA Table 4.2-2 are calculated by using the chemistry factor tables and fluence factor described in RG 1.99, Revision 2, in accordance with Position 1.1. The staff reviewed the initial RT_{NDT} values reported in LRA Table 4.2-2 and determined that, with the exception of the initial RT_{NDT} value for the RPV N16 nozzle, the reported initial RT_{NDT} values were acceptable because they were consistent with those reported for the RPV shell plates in the applicant's response to Generic Letter (GL) No. 92-01, Revision 1, "Reactor Vessel Structural Integrity" dated June 30, 1992, or for the RPV welds fabricated by the Combustion Engineering Company, as documented in the NRC's letter of December 23, 1993, to the Fort Calhoun Station (i.e., to the Omaha Public Power District), which also has a Combustion Engineering-fabricated vessel. In addition, the staff noted that LRA Table 4.2-3 describes the 52-EFPY ART values of the surveillance plate and weld materials based on the available data from the BWRVIP ISP. The staff further noted that LRA Section 4.2.2 states that the representative surveillance plate and weld materials were evaluated for 52 EFPY in accordance with RG 1.99, Revision 2, Position 2.1 (surveillance data available) to generate the ART values in LRA Table 4.2-3. In addition, the staff noted that the LRA and onsite documentation indicate that the reactor vessel surveillance data are described in BWRVIP-135, Revision 2, "Integrated Surveillance Program (ISP) Data Source Book and Plant Evaluations."

As described above, the staff noted that LRA Table 4.2-3 describes the 52-EFPY ART values of the surveillance plate and weld materials. However, the staff noted that LRA Table 4.2-3 is inconsistent with LRA Table 4.2-2 because it does not provide other related data (e.g., material chemistry, chemistry factor, initial RT_{NDT}, and ΔRT_{NDT}) for these materials. Therefore, the staff could not determine the adequacy of these ART values due to the insufficient data. In addition, the staff noted that the LRA does not clearly address whether the ART values based on the surveillance data are used in the other neutron embrittlement TLAAs (e.g., LRA Section 4.2.3 for P-T limits, Section 4.2.5 for circumferential weld inspection relief, and Section 4.2.6 for axial weld failure probability).

By letter dated December 19, 2014, the staff issued RAI 4.2.2-1 requesting that the applicant provide the material chemistry, chemistry factor, initial RT_{NDT}, ΔRT_{NDT}, and other related data for the surveillance materials listed in LRA Table 4.2-3, or justify why LRA Table 4.2-3 does not contain the data. The staff also requested that, as part of the response, the applicant identify the specific heat of each surveillance material that was used to generate credible surveillance data, and the applicant's reactor vessel material that is represented by the surveillance material. In addition, the staff requested that the applicant clarify whether ART values based on credible surveillance data are used as the data of limiting materials in the other neutron embrittlement TLAAs (e.g., LRA Sections 4.2.3, 4.2.5, and 4.2.6). If credible surveillance data are not used, the staff further requested that the applicant state whether the conclusions of these TLAAs are affected by the use of credible ART values.

In its response dated January 30, 2015, the applicant provided the requested data for the surveillance materials in a consistent format with LRA Table 4.2.2-1. The applicant also provided the information regarding the heat of the surveillance materials in companion with the Fermi 2 reactor vessel materials. The applicant further clarified that the heat of the surveillance weld material is identical to the heat used to fabricate the reactor vessel lower shell axial welds (i.e., Tandem Heat No. 13253/12008). In addition, the applicant clarified that the heat of the surveillance plate material is not identical to any heat of the reactor vessel plates so that the surveillance data for the plates are not used in the neutron embrittlement TLAAs.

The applicant stated that the credible ISP data for the lower shell axial welds generated a 52-EFPY ART of 102 °F in accordance with RG 1.99, Revision 2, Position 2.1, which is greater than the ART value (i.e., 87 °F) that would be calculated using Position 1.1 and the chemistry factor tables in RG 1.99, Revision 2. The applicant also clarified that the surveillance data for the limiting plate (heat number C4568-2) generated a 52-EFPY ART of 57 °F per RG 1.99, Revision 2, Position 2.1, and this ART value is the same as that based on RG 1.99, Revision 2, Position 1.1.

The applicant clarified that ART values based on the credible surveillance data per RG 1.99, Revision 2, Position 2.1, were used in the TLAA evaluated in LRA Section 4.2.3, "Pressure-Temperature Limits." The applicant also clarified that the surveillance materials do not include a representative material for the lower shell-to-lower-intermediate shell circumferential weld as documented in LRA Section 4.2.5, "Reactor Vessel Circumferential Weld Inspection Relief."

In its response, the applicant clarified that credible surveillance data, which were available for Welds 2-307A, B, and C (lower shell axial welds), were not used in support of LRA Section 4.2.6, "Reactor Vessel Axial Weld Failure Probability." The applicant revised LRA Section 4.2.6 and Table 4.2-7 to use the credible reactor vessel surveillance data in the analysis of the reactor vessel axial weld failure probability. The applicant stated that in the axial weld failure probability failure analysis, the ART of 102 °F, based on the credible surveillance data, is less than the acceptable bounding value (i.e., 114 °F) described in the staff's SE, dated October 18, 2001, for BWRVIP-74 (ADAMS Accession No. ML012920549). The staff's evaluation of the applicant's revisions to LRA Section 4.2.6 and Table 4.2-7 are documented in SER Section 4.2.6.

Based on its review, the staff finds the applicant's response acceptable because: (1) the applicant adequately provided the reactor vessel surveillance data from the ISP and associated ART values, (2) the applicant clarified that its TLAA on P-T limits uses ART values based on credible surveillance data in accordance with RG 1.99, Revision 2, (3) the applicant clarified that the reactor vessel surveillance materials do not include a material that represents the circumferential weld evaluated in the TLAA on the reactor vessel circumferential weld inspection relief, and (4) the applicant adequately revised its TLAA on reactor vessel axial weld failure probability in accordance with Position 2.1 of RG 1.99, Revision 2, as documented in SER Section 4.2.6. The staff's concern described in RAI 4.2.2-1 is resolved.

As discussed above, LRA Table 4.2-2 describes the 52-EFPY ART values of the reactor vessel beltline components and other data related to the ARTs. In its review, the staff noted that LRA Section 4.2.1 indicates that N16 water level instrumentation nozzles are reactor vessel beltline components because: (1) the peak fluence for these nozzles is projected to be 3.57×10^{17} n/cm^2 (E > 1 MeV) at 52 EFPY, and (2) this exceeds the threshold fluence of 1×10^{17} n/cm^2 for defining a reactor vessel component as a beltline component. However, the staff noted that LRA Table 4.2-2 does not describe ART and other related data (e.g., chemistry data, initial RT_{NDT}, and RT_{NDT}) for the N16 nozzles. The staff could not determine the adequacy of the ART calculations due to the omission of ART and associated data on the N16 nozzles.

By letter dated December 19, 2014, the staff issued RAI 4.2.2-2 requesting that the applicant provide the ART and other related data of N16 nozzles in a format consistent with the other beltline components described in LRA Table 4.2-2. In its response letter dated January 30, 2015, the applicant provided the 52-EFPY ART (i.e., 83 °F) and associated data for the N16 nozzles in a format consistent with the other beltline materials. The staff finds the applicant's response acceptable because the applicant provided the requested information regarding the ART of the N16 nozzles and the ART was calculated for 52 EFPY in accordance with the guidance in RG 1.99, Revision 2. The staff's concern described in RAI 4.2.2-2 is resolved.

In addition, the staff noted that the following reference indicates that, due to insufficient material information, the applicant determined the initial RT_{NDT} value (i.e., unirradiated reference temperature) of the N16 water level instrumentation nozzles using Paragraph B.1.1(4) of NRC Branch Technical Position (BTP) MTEB 5-3, as given in NUREG-0800, Revision 2, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

The staff noted that this initial RT_{NDT} value was established in Section 3.2 of GEH Nuclear Energy Report, NEDO-33785, Revision 0, "DTE Energy/Enrico Fermi Plant 2 Pressure and Temperature Limits Report Up To 24 and 32 Effective Full-Power Years," October 2012 (ADAMS Accession No. ML13004A135).

The NEDO-33785 indicates that testing for the N16 nozzle material, performed at a single temperature (10 °F), generated a minimum Charpy V-notch energy of 30 ft-lb. The NEDO-33785 further indicates that the initial RT_{NDT} of the N16 nozzles was determined to be 30 °F, which is 20 °F above the test temperature, based on NRC BTP MTEB 5-2, Paragraph B.1.1(4). The NRC position, which the applicant used, is currently referred to as NRC BTP 5-3, Paragraph 1.1(4), as described in NUREG-0800, Revision 2, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” Chapter 5, “Reactor Coolant System and Connected Systems,” dated March 2007.

The staff noted that a recent letter from AREVA Inc. to the NRC (ADAMS Accession No. ML14038A265), dated January 30, 2014, addresses a potential nonconservatism in NRC BTP 5-3, Paragraph 1.1(4). The letter indicates that unirradiated RT_{NDT} values as estimated in accordance with BTP 5-3, Paragraph 1.1(4), may not result in a conservative bounding estimate of the unirradiated RT_{NDT}. The staff noted that the LRA and onsite documentation do not clearly address how the applicant will resolve this concern about the potential nonconservatism in the initial RT_{NDT} of N16 water level instrumentation nozzles. By letter dated December 19, 2014, the staff issued RAI 4.2.2-3 requesting that the applicant explain why the initial RT_{NDT} of N16 nozzles in LRA Section 4.2.2 is adequate given the potential nonconservatism in NRC BTP 5-3, Paragraph 1.1(4).

In its response letter dated January 28, 2015, the applicant stated that it is aware of the potential nonconservatism inherent to NRC BTP 5-3, Paragraph 1.1(4), when used to determine initial RT_{NDT} for reactor vessel beltline materials. The applicant also stated that BTP 5-3, Paragraph 1.1(4), was used to determine initial RT_{NDT} for the N16 nozzles because only limited Charpy V-Notch tests were performed at a single temperature for the nozzle material. The applicant further stated that at this time there is no information that suggests that the plant is not operating within its approved licensing basis. In addition, the applicant stated that an industry-wide effort is being organized by the BWRVIP in collaboration with the EPRI PWR Material Reliability Program to evaluate this potential issue and determine if any actions are necessary.

Based on its review of the applicant’s response, the staff noted that the ART calculations for reactor vessel beltline materials are based on the methodology that is part of the applicant’s CLB. The staff also noted that the BWRVIP is coordinating an effort to evaluate potential nonconservatism associated with NRC BTP 5-3 in calculating initial RT_{NDT} for reactor vessel materials. The staff further noted that the potential nonconservatism associated with BTP 5-3 is an operating reactor 10 CFR Part 50 issue and is not within the scope of license renewal, in accordance with 10 CFR 54.30. Therefore, the staff finds the applicant’s response acceptable because the applicant is participating in the industry-coordinated effort to resolve this potential issue that is within the scope of the CLB. The staff’s concern described in RAI 4.2.2-3 is resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the ART 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 4.7.2.1 because the applicant’s analysis adequately evaluates the effects of neutron irradiation embrittlement including the surveillance data in accordance with RG 1.99, Revision 2, and 10 CFR Part 50, Appendix H, “Reactor Vessel Material Surveillance Program Requirements.”

4.2.2.3 UFSAR Supplement

LRA Section A.2.1.2 provides the UFSAR supplement summarizing the TLAA on the ARTs of reactor vessel beltline components. The staff reviewed LRA Section A.2.1.2 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of each TLAA.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA on the ARTs of reactor vessel beltline components, as required by 10 CFR 54.21(d).

4.2.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the ART analysis for the reactor vessel beltline components have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.3 Pressure-Temperature Limits

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3 describes the applicant's TLAA on P-T limits. The NRC regulations in 10 CFR Part 50, Appendix G, require that the reactor vessel remain within established P-T limits during boltup, hydro-test, pressure tests, normal operation, and anticipated operational occurrences. The LRA states that these limits are calculated using materials and fluence data, including data obtained through the Reactor Vessel Surveillance Program (LRA Section B.1.38). The provisions of 10 CFR Part 50, Appendix G, require plants to operate within the licensed P-T limit curves. The P-T limit curves are maintained and updated as necessary to maintain plant operation, in accordance with 10 CFR Part 50, Appendix G. The LRA also states that these P-T limit curves will be updated as necessary through the period of extended operation in conjunction with the Reactor Vessel Surveillance Program. The water level instrumentation nozzles (N16) are also evaluated using the neutron fluence at the nozzles and the material properties of the irradiated nozzles.

The applicant dispositioned the TLAA for the reactor vessel components in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions will be adequately managed in accordance with the requirements of 10 CFR Part 50, Appendix G for the period of extended operation.

4.2.3.2 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 4.2.3.1.3.3. The review procedures indicate that (1) updated P-T limits for the period of extended operation must be available prior to the period of extended operation and (2) an adequate process to maintain and update the P-T limits through the period of extended operation is the 10 CFR 50.90, "Application for Amendment of License, Construction Permit, or Early Site Permit," process for P-T limits located in the limiting conditions of operation (LCOs) of plant TS or an administrative process for updating P-T limits located in a P-T limits report (PTLR), as controlled by the administrative controls section of the plant TS. SRP-LR Section 4.2.3.1.3.3 also states that for BWRs, the staff confirms that the applicant addresses

AAI No. 9 that is specified in the staff's SE for BWRVIP-74 dated October 18, 2001 (ADAMS Accession No. ML012920549). The action item is that the applicant, who has not provided updated P-T limits for the period of extended operation, shall have a process for updating P-T limits prior to the period of extended operation in accordance with 10 CFR Part 50, Appendix G, that will cover 60 years of operation.

The staff reviewed the applicant's CLB to determine whether the applicant controls updates of its P-T limits through updates of the LCOs in the plant TS in accordance with the 10 CFR 50.90 license amendment process, or through a PTLR process that is governed and controlled by the administrative controls section of the plant TS. Specifically, the staff noted that, by letter dated February 4, 2014, the staff approved a license amendment for Fermi 2 that granted the relocation of P-T limit curves from the TS LCOs into a PTLR. In this license amendment, the staff approved the provisions in TS 5.6.8 that will be used to implement the PTLR process for Fermi 2.

The staff further noted that the applicant uses a staff-approved methodology to determine P-T limits for the reactor coolant system as described in GEH Corporation TR NEDC-33178P-A, "GE Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves," Revision 1, dated June 2009. The staff also noted that the methodology for P-T limits is also referenced in TS 5.6.8 of Fermi 2. In addition, the staff noted that the methodology was also used to support a license amendment for measurement uncertainty recapture (MUR) power uprate as approved in the staff's letter to J. Plona dated February 10, 2014. The staff noted that TS 5.6.8 requires that the applicant (a) implement the methodology in GEH Report NEDC-33178P-A, Revision 1, for updates of P-T limits and (b) provide the PTLR to the staff upon issuance for each reactor vessel fluence period and for any revision or supplement thereto. The staff also noted that LRA Appendix C addresses AAI No 9 for BWRVIP-74 by stating that development of P-T limits for the period of extended operation has been evaluated as a TLAA in LRA Section 4.2.3 and that P-T limit curves will continue to be updated in accordance with 10 CFR Part 50, Appendix G.

As discussed above, the staff confirmed that the applicant implemented an administrative controls process (i.e., PTLR process) to update P-T limits through the period of extended operation in accordance with 10 CFR Part 50, Appendix G, and GL 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protections System Limits," dated January 31, 1996. The staff also confirmed that the applicant uses a staff-approved methodology to determine P-T limits as referenced in TS 5.6.8. The staff further noted that the applicant's disposition of this TLAA on P-T limits in accordance with 10 CFR 54.21(c)(1)(iii) is consistent with the incorporation of the PTLR process and the TS 5.6.8 requirements into the CLB. In addition, the staff noted that the applicant adequately addressed AAI No. 9 for BWRVIP-74 to ensure that P-T limits will be updated for the period of extended operation before entering the extended operation.

The staff noted that the applicant uses material test data, which are obtained from the Reactor Vessel Surveillance Program, to determine the ARTs for reactor vessel materials as a measure of neutron irradiation embrittlement. The staff noted that the ARTs used in the P-T limits analysis are determined in accordance with RG 1.99, Revision 2, as documented in SER Section 4.2.2.2. In addition, the staff noted that the neutron fluence for reactor vessel components is calculated in accordance with the guidance in RG 1.190. Therefore, the staff finds that the applicant's TLAA on P-T limits adequately evaluates neutron irradiation effects on reactor vessel components in accordance with the guidance in RG 1.99, Revision 2, and RG 1.190.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the reactor vessel components will be adequately managed in accordance with the PTLR process and TS 5.6.8 requirements during the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.2.2.1.3.3 because the PTLR process and TS 5.6.8 requirements provide an adequate basis for accepting this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.3.3 UFSAR Supplement

LRA Section A.2.1.3 provides the UFSAR supplement summarizing the TLAA on the P-T limits of reactor vessel beltline components. The staff reviewed LRA Section A.2.1.3 consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the reactor vessel neutron embrittlement TLAA.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.2.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA on the P-T limits of reactor vessel beltline materials, as required by 10 CFR 54.21(d).

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended function of the reactor vessel components will be adequately managed for the period of extended operation by the applicant's implementation of the PTLR process and TS 5.6.6 requirements. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.4 Upper-Shelf Energy

The NRC's requirements for performing USE analyses of ferritic base-metal components (i.e., plate or forging components) and ferritic weld components in the beltline region of the RPV are specified in 10 CFR Part 50, Appendix G. The rule requires the USE values for these RPV components to be greater than or equal to 50 ft-lb at the end of the licensed operating period. These analyses are TLAAs because the analyses meet all six of the criteria in 10 CFR 54.3(a) that define an analysis as a TLAA.

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 describes the applicant's TLAA evaluation for calculating the USE values for base metal and weld components that are made from ferritic steel materials and are located in the beltline region of the RPV. The LRA states that the applicant calculated the USE values using methods that are consistent with NRC's methods of analysis in RG 1.99, Revision 2. The LRA states that these calculations are based on the peak neutron fluence values for the 1/4T locations of the components in the RPV through 52 EFPY, which bounds the maximum possible EFPY at the end of the period of extended operation. The LRA also states that the applicant adjusted the fluence values for the RPV axial weld locations, where appropriate. Concerning the results, the LRA states that the USE values for all of the ferritic steel components in the RPV will remain above 50 ft-lb throughout the period of extended operation.

The applicant dispositioned the TLAA for USE of the RPV beltline materials in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA on USE for the RPV beltline region metal and weld components, and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.2.3.1.1.2. Specifically, the SRP-LR states that the staff is to review the documented results of the applicant's updated USE analysis based on the projected neutron fluence at the end of the period of extended operation and compare the analytical results against the USE analysis requirements in 10 CFR Part 50, Appendix G. The regulation requires the USE values for the ferritic base-metal components (i.e., plates or forged components) and ferritic weld components in the beltline region of the RPV to be greater than or equal to 50 ft-lb at the end of the licensed operating period.

Concerning the neutron fluence projections, SRP-LR Section 4.2.3.1.1.2 states that the applicant should identify the neutron fluence at the 1/4T location for each RPV beltline component at the expiration of the license renewal period. The staff reviewed LRA Table 4.2-4 and determined that it contains this information. SRP-LR Section 4.2.3.1.1.2 also states that the applicant should identify the methodology that it used to determine the neutron fluence projections and indicate whether this methodology follows the guidance in RG 1.190. The staff noted that LRA Section 4.2.1 indicates that the applicant determined the neutron fluence values using the methodology in GE Report NEDO-32983-A, Revision 2, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," dated January 2006 (ADAMS Accession No. ML072480121), and that this methodology adheres to the guidance in RG 1.190. Based on a review of the staff's SEs on this methodology, which were transmitted by letters dated September 14, 2001 (ADAMS Accession No. ML012400381), and November 17, 2005 (ADAMS Accession No. ML053210469), the staff confirmed that NEDO-32983-A, Revision 2, is a staff-approved methodology that follows the guidance in RG 1.190. Therefore, the staff determined that the applicant's 1/4T fluence projections for the updated USE analysis are acceptable.

To confirm that the revised USE analysis meets the requirements of 10 CFR Part 50, Appendix G, at the end of the period of extended operation, SRP-LR Section 4.2.3.1.1.2 states that the staff should determine whether the applicant followed the guidance in RG 1.99, Revision 2, to perform the update of the USE analysis or whether the applicant used an equivalent margins analysis as the basis for complying with USE requirements in10 CFR Part 50, Appendix G. The staff noted that the LRA indicates that the applicant used the guidance in RG 1.99, Revision 2, to perform its update of the USE analysis; therefore, the staff reviewed this analysis to confirm that it adheres to the guidance in RG 1.99, Revision 2.

SRP-LR Section 4.2.3.1.1.2 states that, for reviews of RPV beltline component USE analyses, the reviewer should confirm that the applicant has provided both the UUSE values and the projected USE values for the components at the end of the license renewal period. The SRP-LR also states that the reviewer should determine whether the percent decreases in the USE values were established using the limit lines in Figure 2 of RG 1.99, Revision 2, or from applicable RPV surveillance data obtained from implementation of 10 CFR Part 50, Appendix H, “Reactor Vessel Material Surveillance Program Requirements.” The staff’s review of LRA Section B.1.38, “Reactor Vessel Surveillance,” is documented in SER Section 3.0.3.2.19. LRA Table 4.2-4 provides these values for the lower shell plate, lower-intermediate shell plate, axial weld, and circumferential weld components in the RPV, along with the values for the percent copper content.

The staff reviewed the UUSE values reported in LRA Table 4.2-4 and determined that, with the exception of the UUSE value for the RPV N16 nozzle, the reported UUSE values were acceptable because they were consistent with those reported for the RPV shell plates in the applicant’s response to GL No. 92-01, Revision 1, “Reactor Vessel Structural Integrity,” dated June 30, 1992, or for RPV weld materials, as provided in NRC documentation for CE-fabricated vessel welds, in BWRVIP-74-A for non-Linde 80 submerged arc welds, or in other applicable BWRVIP reports. However, the staff noted that LRA Table 4.2-4 appeared to be incomplete because it did not provide the UUSE value or the percent decrease in USE value for the RPV’s N16 instrumentation nozzle. In addition, it was not evident which methodology was used to establish the UUSE value and percent decrease in USE value for the N16 instrumentation nozzle. By letter dated January 26, 2015, the staff issued RAI 4.2.4-1, requesting that the applicant provide these values and identify and justify the methodology that was used to establish or calculate them. Alternatively, the staff requested that the applicant provide an explanation as to why LRA Table 4.2-4 omits the UUSE and percent decrease in USE values for the N16 instrumentation nozzle.

By letter dated March 5, 2015, the applicant provided its response to RAI 4.2.4-1. In its response, the applicant provided a proprietary UUSE value for the RPV N16 instrumentation nozzle plate materials that was lower than and more conservative than the nonproprietary UUSE values that were reported for the shell plates in the lower shell and lower-intermediate shells of the RPV. The applicant stated that the UUSE value was determined from Charpy-impact data in a set of fleetwide certified material test reports. The applicant stated that the UUSE value was calculated using a statistical 95/95 lower tolerance limit as defined in Section 9.12, “Statistical Tolerance Limits for a Normal Population,” to NUREG-1475, “Applying Statistics,” Revision 1, dated March 2011 (ADAMS Accession No. ML11102A076). The applicant stated that, using the 52-EFPY 1/4T fluence of 2.47 x 10^{17} n/cm^2 (E > 1 MeV) for the N16 instrumentation nozzle, it identified a 16 percent decrease in USE value for the N16 instrumentation nozzle. Based on its assessment, the applicant identified a 52 ft-lb USE value for the N16 instrumentation nozzle at the end of the period of extended operation (i.e., at 52 EFPY).

Based on the UUSE and copper content values reported in the response to RAI 4.2.4-1, the staff independently calculated that the percent decrease in USE value for the N16 nozzle was 16 percent of the UUSE value reported for the component. Based on its review, the staff finds the applicant’s response acceptable because (1) the applicant has provided the UUSE and percent decrease in USE values for the N16 instrumentation nozzle plate materials and (2) the staff has confirmed that these values are based on conservatively established bases in staff-accepted reports and the USE analysis guidelines in RG 1.99, Revision 2, and are acceptable when compared to those independently calculated by the staff. The staff’s concern described in RAI 4.2.4-1 is resolved.

SRP-LR Section 4.2.3.1.1.2 also states that the applicant should indicate whether it calculated the percent decrease in USE values using the USE calculation extrapolation lines in Figure 2 of RG 1.99, Revision 2, or whether it used available surveillance data. RG 1.99, Revision 2, Regulatory Position 1.2, describes the former approach, whereas Regulatory Position 2.2

describes the latter approach. Based on its review of LRA Table 4.2-4, the staff determined that the applicant used Regulatory Position 1.2 to determine the percent decrease in USE values for all of the plate and axial weld components in the lower shell and lower-intermediate shell of the RPV, and for the lower shell-to-lower intermediate shell girth weld and plate material used in the fabrication of the RPV N16 instrumentation nozzle. The staff reviewed these values and, given the percent copper content and fluence projection values for each RPV component material, confirmed that the applicant correctly calculated them using Figure 2 in RG 1.99, Revision 2.

LRA Table 4.2-4 indicates that the applicant also used Regulatory Position 2.2 to determine the percent decrease in USE values for the vertical and girth weld materials based on data from the BWR ISP. In addition, LRA Table 4.2-5 provides fluence and USE values from the ISP for plates and welds. However, the staff could not determine how the ISP data were applied to RPV USE calculations for 52 EFPY because the LRA did not include all of the relevant ISP data that are representative of the plate and weld components in the RPV. By letter dated January 26, 2015, the staff issued RAI 4.2.4-2 requesting that the applicant provide all host reactor capsule testing data from the ISP that were used in USE calculations of RPV axial welds and circumferential weld components in the RPV at 52 EFPY. The staff also requested the applicant to explain how the ISP data were applied to the USE calculations for these components at 52 EFPY.

By letter dated March 5, 2015, the applicant provided its response to RAI 4.2.4-2. The staff noted that the applicant’s response to RAI 4.2.4-2 provided the applicable appropriate ISP data for ISP host reactor welds that are evaluated and have a direct match to heat of materials used in the fabrication of the beltline weld components in the Fermi 2 RPV. The staff confirmed that, for the Fermi 2 RPV, this is the heat of material used (Tandem Heat No. 13253/12008) in the fabrication of RPV lower shell axial welds 2-307, A, B, and C. The staff finds this to be acceptable because the staff has determined that the data are consistent with those reported for Fermi 2 in applicable BWRVIP reports, as submitted for implementation of the ISP. The staff did not apply the ISP data to the USE calculations for the materials used to fabricate lower intermediate shell axial welds 15-308, A, B, and C (i.e., weld heat No. 33A277) and the lower shell-to-lower intermediate shell circumferential weld 1-313 (i.e., weld heat No. 10137) because the supplemental surveillance program capsules E and G in the ISP (as pulled on behalf of the Fermi 2 RPV welds) do not include these heats of material. This is consistent with the basis in BWRVIP-86, Revision 1-A. The staff’s concern described in RAI 4.2.4-2 is resolved.

SRP-LR Section 4.2.3.1.1.2 states that the applicant should also provide the results of revised USE analysis (i.e., the USE values), as projected at the end of the period of extended operation. LRA Table 4.2-4 provides the USE values for all RPV beltline components at the end of the period of extended operation (i.e., through 52 EFPY). The staff noted that this includes the USE values that were performed at 52 EFPY for the N16 instrumentation nozzle plates, the RPV shell plates and axial welds in the lower shell and lower-intermediate shells of the RVP, and the RPV’s lower shell-to-lower intermediate shell circumferential weld. The staff confirmed that all of these values were calculated correctly in accordance with methods of analysis in Regulatory Position 1.2 of RG 1.99, Revision 2. The staff also confirmed that the applicant provided the 52-EFPY USE calculation for the RPV lower shell axial welds 2-307, A, B, and C using the applicable RPV surveillance data from the ISP. From these results, the staff confirmed that the applicant’s assessment is limited by the USE calculation for the RPV N16 instrumentation nozzle, with a projected USE value of 52 ft-lb at the end of the period of extended operation (i.e., at 52 EFPY).

The staff performed independent calculations of the USE values for the RPV welds, nozzles, and plates at the end of the period of extended operation based on the data provided in the LRA, as amended in the applicant's responses to RAIs 4.2.4-1 and 4.2.4-2. The staff's calculations included calculations of the USE value for the RPV lower shell axial welds (Nos. 2-307, A, B, and C) using both the method of analysis in Regulatory Position 1.2 and Regulatory Position 2.2 of RG 1.99, Revision 2, which is the method that is used if there are applicable surveillance data that apply to the USE analysis. Based on its independent assessment, the staff confirmed that the USE analysis is limited by the 52-EFPY projection for the RPV's N16 instrumentation nozzle. The staff independently calculated a USE value greater than 50 ft-lb for the N16 instrumentation nozzles at the end of the period of extended operation (i.e., at 52 EFPY). The applicant's limiting USE value (52 ft-lb) and staff's independent calculation of the limiting USE value (greater than 50 ft-lb) demonstrate that the USE values for the ferritic base-metal (i.e., plates) and weld components in the RPV will meet the lower-bound 10 CFR Part 50, Appendix G, requirement of 50 ft-lb at the end of the period of extended operation.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analysis for the RPV has been adequately projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.2.2.1.1.2 because the RPV beltline components were re-evaluated to consider the period of extended operation in accordance with 10 CFR Part 50, Appendix G.

4.2.4.3 UFSAR Supplement

LRA Section A.2.1.4 provides the UFSAR supplement summarizing the TLAA for USE of the RPV beltline materials. The staff reviewed LRA Section A.2.1.4 consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer is to verify that the applicant has provided a supplement with information that is equivalent to the examples in SRP-LR Table 4.2-1.

The staff compared the summary description in LRA Section A.2.1.4 against the example for USE analyses in SRP-LR Table 4.2-1. Whereas the example summary description includes a comparison of the results of the revised USE analysis against the requirements of 10 CFR Part 50, Appendix G, the staff found that no such information is included in the summary description proposed by the applicant. The staff determined that the applicant's summary description does not contain adequate information regarding the basis for its demonstration made pursuant to 10 CFR 54.21(c)(1)(ii). Therefore, by letter dated January 26, 2015, the staff issued RAI 4.2.4-3 requesting that the applicant provide justification as to why the results of the TLAA are not included in the UFSAR supplement. Otherwise, the staff requested that the applicant revise LRA Section A.2.1.4 to include a comparison of the results of the revised USE analysis against the requirements of 10 CFR Part 50, Appendix G.

By letter dated March 5, 2015, the applicant provided its response to RAI 4.2.4-3. In its response, the applicant amended UFSAR supplement Section A.2.1.4 to state:

> [USE] is evaluated for beltline materials. Fracture toughness criteria in 10 CFR 50 Appendix G require that beltline materials maintain USE no less than 50 ft-lb during operation of the reactor. The 52 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99. The determination used the peak 1/4T fluence. The results of the evaluation demonstrate that all beltline material remains above 50 ft-lb throughout the

> period of extended operation. The [TLAA] for [USE] has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

The staff reviewed the applicant's response to RAI 4.2.4-3 and amended version of UFSAR Supplement Section A.2.1.4 and finds it acceptable because the UFSAR supplement provides sufficient information to describe how the TLAA on USE has been projected to the end of the period of extended operation and why the projected analysis meets the USE analysis requirements in 10 CFR Part 50, Appendix G. The staff's concern described in RAI 4.2.4-3 is resolved.

Based on its review of the UFSAR supplement, as amended in the letter of March 5, 2015, the staff finds it meets the acceptance criteria in SRP-LR Section 4.2.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the USE of the RPV beltline materials, as required by 10 CFR 54.21(d).

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the USE of the RPV beltline materials has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.5 Reactor Vessel Circumferential Weld Inspection Relief

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 describes the applicant's TLAA for the probabilistic fracture mechanics analysis based on 52-EFPY mean RT_{NDT} for the RPV circumferential welds. The LRA states that relief from the inservice inspection (ISI) requirements of the RPV circumferential welds was requested in a relief request (No. RR-A25) dated August 19, 1999. This relief request was supplemented in a letter dated March 15, 2000.

The applicant stated that a re-evaluation of the circumferential weld inspection relief basis for power operations up to 32 EFPY was included in the MUR power uprate submittal to evaluate the effects of the increased power as approved by the NRC. The applicant stated that the method used in the MUR power uprate re-evaluation was also used to evaluate the acceptability of the relief through the period of extended operation (up to 52 EFPY).

The LRA states that the staff's final safety evaluation report (FSER) for the BWRVIP-05 report identifies that a licensee may request relief from the ASME-defined volumetric ISI requirements for RPV circumferential welds by demonstrating that they meet the following acceptance criteria: (a) at the expiration of the license, the circumferential welds will satisfy the limiting conditional failure probability for the circumferential welds, and (b) operator training and procedures that limit the frequency of cold over-pressure events to the amounts specified in the FSER will be implemented. The applicant stated that the CLB includes procedures and TS requirements for monitoring and controlling reactor pressure, temperature, and water inventory during all aspects of cold shutdown operations in order to minimize the likelihood of a LTOP event. The applicant stated that it also provides operator training for implementation of these procedures.

The LRA indicates that the RPV was fabricated by CE. LRA Table 4.2-6 provides a comparison of the limiting mean RT_{NDT} value of the circumferential welds in the Fermi 2 RPV to that listed in the BWRVIP-05 report for circumferential welds in CE-designed RPVs. The applicant stated that LRA Table 4.2-6 demonstrates that the mean RT_{NDT} value for the limiting circumferential weld in the Fermi 2 RPV is less than the limiting mean RT_{NDT} value listed in the BWRVIP-05 report for CE-designed RPV circumferential weld components. The LRA also states that ISI examinations of the RPV axial welds are performed in accordance with 10 CFR 50.55a and the applicable ASME Code Section XI ISI requirements for performing volumetric examinations of these types of welds. The applicant stated that previous ISI examinations of the axial welds in the RPV have not revealed any active mechanistic mode of degradation in the axial welds. The applicant also stated that examination of the circumferential welds will be performed if axial welds examinations reveal an active mechanistic mode of degradation. The applicant further stated that a request for relief for the period of extended operation will be submitted to the NRC in accordance with 10 CFR 50.55(a), and that this serves as an acceptable basis for demonstrating that the effects of aging associated with the reactor vessel circumferential weld inspection relief TLAA will be managed in accordance with the requirements in 10 CFR 54.21(c)(1)(iii).

4.2.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA associated with the RPV circumferential weld inspection and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.2.3.1.4, which state the following:

> The staff verifies that the applicant has identified that, should the inspection relief be desired for the period of extended operation, an application will be made under 10 CFR 50.55a(a)(3) prior to entering the period of extended operation. If the applicant indicates that relief from circumferential weld examination will be made under 10 CFR 50.55a(a)(3), the applicant will manage this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

In addition, the acceptance criteria in SRP-LR Section 4.2.2.1.4 states that some BWRs have an approved technical alternative, which eliminates the reactor vessel circumferential shell weld inspections for the current license term because they satisfy the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 and the extent of neutron embrittlement. The acceptance criteria in SRP-LR Section 4.2.2.1.4 is based on the alternative probabilistic fracture mechanics methodology in BWRVIP-05. The staff confirmed that the applicant had requested the applicable code relief of the RPV circumferential welds for the current operating period in Relief Request No. RR-A25, dated March 15, 2000. The staff approved Relief Request No. RR-A25 in an SE dated March 30, 2000 (ADAMS Accession No. ML003697623).

The staff reviewed the mean RT_{NDT} calculation and data that were provided in LRA Table 4.2-6 for the RPV circumferential welds to determine whether the TLAA can be accepted in accordance with the criterion in 10 CFR 54.21(c)(1)(iii), such that a relief request could be submitted for the RPV circumferential welds for the period of extended operation. The staff reviewed the applicant's mean RT_{NDT} in comparison to a limiting mean RT_{NDT} acceptance criterion value of 113 °F, as discussed in the staff's SE report for the BWRVIP-05 report.

The staff confirmed that all of the input parameters (i.e., copper (Cu) and nickel (Ni) alloying contents and unirradiated RT_{NDT} value) used for the mean RT_{NDT} calculation in LRA Table 4.2-6 were consistent with those incorporated in the CLB for Fermi 2 and provided in previous correspondence letters to the NRC, including the applicant's responses to GL 92-01, Supplement 1, and GL 92-01, Supplement 1, Revision 1.

The staff also noted the applicant's mean RT_{NDT} calculation uses the cumulative RPV inside surface neutron fluence for the limiting RPV circumferential weld (i.e., RPV weld 1-313, as made from Heat No. 10137) as reported for 52 EFPY in LRA Table 4.2-2. The staff found this neutron fluence value to be acceptable for the calculation because the staff has confirmed that the 52-EFPY neutron fluence value was calculated in accordance with the applicable GEH neutron fluence methodology that was approved for the CLB by the staff's SE of September 14, 2001 (ADAMS Accession No. ML012400381), as supplemented by the SE of November 17, 2005 (ADAMS Accession No. ML053210469).

In addition, the staff noted that the applicant's mean RT_{NDT} calculation applies the appropriate chemistry factor for the weld heat of material, as determined from the Cu and Ni alloying contents for the material and Table 1 of RG 1.99, Revision 2. The staff also confirmed that the mean RT_{NDT} value of 48.3 °F, as projected for the RPV circumferential weld 1-313 at 52 EFPY, is lower than the limiting mean RT_{NDT} value of 113 °F that was discussed in the staff's SE for the BWRVIP-05 report. Therefore, based on these confirmations, the staff confirmed that the mean RT_{NDT} value calculated for RPV lower shell-to-lower intermediate shell weld 1-313 was acceptable because it was both consistent with the method for calculating mean RT_{NDT} values in the BWRVIP-05 report and less than the mean RT_{NDT} value discussed in the staff's SE for the BWRVIP-05 report.

The staff noted that LRA Section B.1.38 provides the applicant's Reactor Vessel Surveillance Program and indicates that the AMP is based on implementation of the BWRVIP ISP that has been approved by the staff in BWRVIP-86, Revision 1-A. The staff noted that this AMP relies on specific RPV surveillance data that are obtained from specific RPV surveillance materials in host reactors that are representative of the base metal and weld materials used in the fabrication of the Fermi 2 RPV. However, the staff noted that LRA Table 4.2-6 did not include an analogous mean RT_{NDT} analysis for RPV circumferential weld 1-313 that was based on the use of ISP surveillance data for the facility's RPV welds. The staff noted that additional information was needed for the applicant to demonstrate acceptance of this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

By letter dated December 17, 2014, the staff issued RAI 4.2.5-1, requesting that the applicant clarify whether the surveillance weld materials from the host reactors representing Fermi 2 in the BWRVIP ISP (i.e., the BWRVIP-86, Revision 1-A program) are a match to the weld heat for RPV circumferential weld 1-313 (i.e., Heat No. 10137). If so, the staff requested the applicant to provide the basis as to why LRA Table 4.2-6 did not include an additional mean RT_{NDT} calculation for this circumferential weld using (a) the applicable ISP surveillance weld data from the host reactors and (b) the methodology in Section 5.2 of BWRVIP-86, Revision 1-A, for calculating the chemistry factor and ΔRT_{NDT} values using the applicable ISP surveillance weld data. The staff also requested that, if the heat of material for surveillance weld materials in the host reactors is not a match to the heat of material for RPV circumferential weld 1-313, the applicant should clarify how the ISP surveillance weld data from the host reactors supports the adequacy of the predicted ΔRT_{NDT} value used in the mean RT_{NDT} calculation for RPV circumferential weld 1-313, as provided in LRA Table 4.2-6.

By letter dated January 15, 2015, the applicant provided its response to RAI 4.2.5-1. In its response, the applicant clarified that the surveillance weld materials from the host reactors representing Fermi 2 in the BWRVIP ISP are not a match to weld heat for RPV lower shell-to-lower intermediate shell circumferential weld 1-313 (i.e., Heat No. 10137). The staff noted that the applicant would only apply the RPV surveillance data as the basis for performing the RT_{NDT} calculation for this weld if the welds in the ISP host reactors were made from the same heat of material used in the fabrication of weld 1-313. Based on this information, the staff finds that the chemistry factor tables in RG 1.99, Revision 2, are the appropriate basis for performing the calculation of the mean RT_{NDT} calculation for lower shell-to-lower intermediate shell circumferential weld 1-313 because the host reactor surveillance data do not apply to the heat of material used to fabricate weld 1-313. The staff's concern described in RAI 4.2.5-1 is resolved.

In the BWRVIP-05 report and in Section 4 of the SE for the BWRVIP-05 report, the staff approved the EPRI BWRVIP basis that the relief from the ASME Code inspections will not be valid, and that the ASME-defined volumetric inspections of the RPV circumferential welds will need to be performed if the corresponding ISI examinations of the RPV axial welds reveal the presence of an active age-related degradation mechanism in the welds. The staff noted that LRA Section 4.2.5 states that examinations of the RPV circumferential welds will be performed if the ISI examinations of the RPV axial welds "reveal an active mechanistic mode of degradation." The staff found this statement to be acceptable because it is consistent with the basis in the BWRVIP-05 report and the corresponding staff's FSER.

The staff also noted that LRA Section 4.7.5 provides the applicant's plant-specific TLAA for flaws that were detected in the applicant's RPV and the basis for dispositioning this TLAA in accordance with 10 CFR 54.21(c)(1)(ii). However, the staff noted that LRA Section 4.7.5 did not indicate whether these flaws were located in the RPV welds or had initiated or are growing as the result of an active mechanistic mode of degradation (i.e., as a result of an age-related initiation or growth mechanism).

By letter dated December 17, 2014, the staff issued RAI 4.2.5-2, requesting that the applicant clarify whether the RPV flaws discussed in LRA Section 4.7.5 were detected in any of the welds used in the fabrication of the RPV. The staff also asked the applicant to identify whether the flaws had initiated or are currently growing as a result of an active degradation mechanism, and if so, to justify whether volumetric inspections of the RPV circumferential welds would need to be performed during the period of extended operation in accordance with the applicable ASME Code Section XI ISI requirements.

By letter dated January 15, 2015, the applicant provided its response to RAI 4.2.5-2. In its response, the applicant stated that the applicable RPV flaws were detected in an RPV fabrication weld and were associated with slag deposits resulting from the welding process. The applicant stated that the flaws are subsurface flaws, which were evaluated by a detailed fracture mechanics analysis that demonstrated that the flaws are not susceptible to flaw growth. The applicant also stated that repeated examination has confirmed that there has been no growth of these flaws.

The staff finds the applicant's response acceptable because it demonstrated that the RPV flaws are not associated with an active degradation issue that, if otherwise present, would require the applicant to perform the ASME-defined volumetric inspections of the RPV circumferential welds during the period of extended operation and would invalidate any basis for requesting approval of an ISI relief request for the welds during the period of extended operation in accordance with 10 CFR 50.55a(z). The staff's concern described in RAI 4.2.5-2 is resolved.

For the second criterion for RPV circumferential weld relief request acceptance, the applicant stated that it has implemented operator training and established procedures that limit the frequency of cold over-pressure events to the levels specified in the staff's FSER for the BWRVIP-05 report. The applicant also stated that the CLB includes procedures and TS requirements for monitoring and controlling reactor pressure, temperature, and water inventory during all aspects of cold shutdown operations to minimize the likelihood of an LTOP event at Fermi 2. Although this is not specifically related to any time-limited parameter subject to a TLAA review, the staff finds that the continued implementation of operator training and procedures to limit the frequency of cold over-pressure events meets the second criterion in the staff's FSER for the BWRVIP-05 report.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking on the intended functions of the RPV circumferential welds will be adequately managed for the period of extended operation. Additionally, the applicant's analysis meets the acceptance criteria in SRP-LR Section 4.2.2.1.4 because:

(a) The applicant has demonstrated that the conclusions of the BWRVIP-05 report are applicable to and valid for the design of the RPV circumferential welds at Fermi 2 during the period of extended operation.

(b) The applicant plans to reapply for code relief from the ISI requirements that will apply to BWR RPV circumferential welds during the period of extended operation in accordance with the alternative ISI program requirements in 10 CFR 50.55a(z).

(c) This provides an adequate basis for accepting this TLAA in accordance the requirements in 10 CFR 54.21(c)(1)(iii).

4.2.5.3 UFSAR Supplement

LRA Section A.2.1.5 provides the UFSAR supplement summarizing the TLAA evaluation of the RPV circumferential welds inspection relief. The staff reviewed LRA Section A.2.1.5 consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer should verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.2.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA on the RPV circumferential welds inspection, as required by 10 CFR 54.21(d).

4.2.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking on the intended functions of the RPV circumferential welds will be adequately managed by the ISI relief request process for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.6 Reactor Vessel Axial Weld Failure Probability

4.2.6.1 Summary of Technical Information in the Application

LRA Section 4.2.6 describes the applicant's TLAA for probabilistic fracture mechanics and mean RT_{NDT} analysis for the RPV axial welds. The applicant stated that the staff's FSER for the BWRVIP-74-A report evaluated the failure frequency of axially-oriented welds in BWR reactor vessels. The applicant stated that applicants for license renewal must evaluate axially-oriented RPV welds to show that their failure frequency remains below the value calculated in the BWRVIP-74-A report. The SER states that an acceptable way to do this is to show that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in the report.

The applicant stated that LRA Table 4.2-7 compares the Fermi 2 reactor vessel limiting axial weld parameters to those summarized in the FSER for the BWRVIP-74-A report. The applicant clarified that the calculations summarized in LRA Table 4.2-7 are based on the neutron fluence at the inside surface for the limiting RPV axial shell weld, but do not include a margin term value (i.e., an additional RT_{NDT} value added into the calculation as a safety basis decision). The applicant stated that LRA Table 4.2-7 demonstrates that the projected mean RT_{NDT} value of 66 °F for limiting RPV axial welds at 52 EFPY is less than the bounding mean RT_{NDT} value of 114 °F listed in BWRVIP-74-A report for BWR-4 designed RPVs. The applicant also stated that this demonstrates that the RPV failure frequency listed in the BWRVIP-74-A report (i.e., a probability of failure value of $5x10^{-6}$ per reactor-year) for BWR-4 RPV axial shell welds is acceptable and applicable to the design of the RPV axial shell welds at Fermi 2.

The applicant dispositioned the probability of failure TLAA for the RPV axial shell welds in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.6.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the RPV axial shell weld probability of failure analysis, and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.2.3.1.5, which state the following:

> To demonstrate that the vessel has not been embrittled beyond the basis for the staff and BWRVIP analyses, the applicant should provide (a) a comparison of the neutron fluence, initial RT_{NDT}, chemistry factor amounts of copper and nickel, delta RT_{NDT}, and mean RT_{NDT} of the limiting axial weld at the end of the license renewal period to the reference case in the BWRVIP and staff analyses and (b) an estimate of conditional failure probability of the RPV at the end of the license renewal term based on the comparison of the mean RT_{NDT} for the limiting axial welds and the reference case. If this comparison does not indicate that the RPV failure frequency for axial welds is less than 5×10^{-6} per reactor year, the applicant should provide a probabilistic analysis to determine the RPV failure frequency for axial welds. Consistent with the staff's supplemental [SER] of BWR Vessel and Internals Project BWRVIP-05 Report, dated May 7, 2000 . . ., the staff should ensure that the applicant's plant is bounded by the BWRVIP-05 analysis or that the applicant has committed to a program to monitor axial weld embrittlement relative to the values specified by the staff in its May 7, 2000, SER.

The SRP-LR also states that the staff confirms that the applicant has addressed action item 12 in the staff's SER for BWRVIP-74.

The staff noted that the applicant performed applicable mean RT_{NDT} calculations of the limiting axial shell welds for the current operating term as part of supporting technical information and calculations needed for the processing of relief request RR-A25, which was approved in the staff's SE, "Fermi 2 Relief Requests for the Second 10-Year Interval Inservice Inspection (ISI) Nondestructive Examination (NDE) Program," dated March 30, 2000 (ADAMS Accession No. ML003697623). The staff reviewed the updated mean RT_{NDT} calculation in LRA Table 4.2-7 for 52 EFPY against the mean RT_{NDT} calculation performed in the BWRVIP-05 report for the Pilgrim Mod-2 case study. This case study is applicable to RPV axial shell welds and establishes a limiting mean RT_{NDT} value of 114 °F and a probability of failure value of $5x10^{-6}$ per reactor year for RPV axial shell welds.

The staff confirmed that the Cu and Ni alloying contents and unirradiated RT_{NDT} value used for the mean RT_{NDT} calculation in LRA Table 4.2-7 were consistent with those provided in previous correspondence letters to the NRC, including the applicant's response to GL 92-01, Revision 1, and GL 92-01, Revision 1, Supplement 1, and thus, are consistent with the CLB for Fermi 2. The staff also noted that LRA Section 4.2.6 identified a mean RT_{NDT} of 66 °F for the limiting axial welds in the RPV (i.e., RPV lower shell axial welds 2-307 A, B, and C, which are tandem welds made from Heat No. 13253/12008).

The staff noted that LRA Section B.1.38 describes the applicant's Reactor Vessel Surveillance Program for the LRA and indicates that the AMP is based on implementation of the BWRVIP ISP that has been approved by the staff in BWRVIP-86, Revision 1-A. The staff noted that this AMP relies on specific RPV surveillance data that are obtained from specific RPV surveillance materials in host reactors that are representative of the base and weld materials used in the fabrication of the Fermi 2 RPV. However, the staff noted that LRA Table 4.2-7 did not include a mean RT_{NDT} analysis for RPV lower shell axial welds 2-307 A, B, and C that is based on the ISP surveillance data for these weld components and is calculated (in part) using Section 5.2 of BWRVIP-86, Revision 1-A, for the chemistry factor and ΔRT_{NDT} values used in the mean RT_{NDT} analysis.

By letter dated December 17, 2014, the staff issued RAI 4.2.6-1, requesting that the applicant clarify whether the heat of material for surveillance weld materials from the host reactors in the ISP were a direct match to the weld heat for RPV lower shell axial welds 2-307 A, B, and C, which are the limiting RPV axial welds in the mean RT_{NDT} analysis. If so, the staff asked the applicant to provide the basis for why LRA Table 4.2-7 did not include an additional mean RT_{NDT} calculation for these axial welds using (a) the applicable ISP surveillance data and (b) the methodology for calculating chemistry factor and ΔRT_{NDT} values in Section 5 of BWRVIP-86, Revision 1-A. Otherwise, the staff asked the applicant to clarify how the ISP surveillance weld data from the host reactors support the adequacy of the predicted ΔRT_{NDT} value used in the mean RT_{NDT} calculation for RPV axial welds 2-307A, B, and C.

By letter dated January 30, 2015, the applicant provided its response to RAI 4.2.6-1. In its response, the applicant stated that the heat of material for the RPV axial weld materials in the host reactors for the ISP was a direct match to the heat of material that was used to fabricate RPV lower shell axial welds 2-307 A, B, and C. The applicant amended the 52-EFPY neutron fluence value reported in LRA Table 4.2-7 from a value of $0.143x10^{19}$ n/cm^2 (as reported in LRA Section 4.2.1 for inside surface of RPV circumferential shell weld 1-313) to a value of $0.100x10^{19}$ n/cm^2 (as reported in LRA Section 4.2.1 for inside surface of RPV lower shell axial welds 2-307, A, B, and C). The staff found the amended neutron fluence value acceptable for the calculations of the mean RT_{NDT} of the axial welds because (a) the change is consistent with the neutron fluence provided in LRA Table 4.2-1 for these axial weld components and (b) the staff has confirmed that the neutron fluence values reported in LRA Section 4.2.1 for 52 EFPY were calculated in accordance with the applicable GEH neutron fluence methodology approved for the CLB (this information is in the SE of September 14, 2001 (ADAMS Accession No. ML012400381), as supplemented by the SE of November 17, 2005 (ADAMS Accession No. ML053210469)).

Based on this neutron fluence value change, the applicant amended the mean RT_{NDT} value that was reported for these welds using the methods in RG 1.99, Revision 2, from a value of 66 °F to an amended value of 49 °F. The applicant also amended LRA Table 4.2-7 to include an additional mean RT_{NDT} calculation for RPV lower shell axial welds 2-307 A, B, and C that was based on (a) the amended inside surface neutron fluence value of $0.100x10^{19}$ n/cm^2 reported for RPV lower axial welds 2-307 A, B, and C, (b) the host reactor surveillance data obtained from the implementation of the ISP, and (c) the staff-approved methodology for performing RT_{NDT} calculations in the BWRVIP-86, Revision 1-A, report, as modified for mean RT_{NDT} calculation margin term bases in the staff-approved version of the BWRVIP-05 report. Therefore, the staff noted that the applicant conservatively calculated an ISP-based mean RT_{NDT} value of 102 °F for these axial welds using the applicable RPV surveillance data obtained from the applicant's implementation of its ISP. Based on this assessment, the staff confirmed the applicant performed two acceptable mean RT_{NDT} calculations for RPV lower axial welds 2-307, A, B, and C that demonstrate that the mean RT_{NDT} values reported for the welds at 52 EPFY (i.e., mean RT_{NDT} values of 49 °F and 102 °F, respectively) are bounded by the limiting mean RT_{NDT} value of 114 °F, as reported in the BWRVIP-05 report for BWR-4 RPV axial weld components.

The staff noted that, in the FSER for the BWRVIP-74-A report, dated October 18, 2001 (ADAMS Accession No. ML012920549), the staff included AAI No. 12, which requested that BWR license renewal applicant take the following actions with respect to information provided in their LRAs:

> As indicated in the staff's March 7, 2000, letter to Carl Terry [i.e., letter enclosing the FSER on TR No. BWRVIP-05 to Mr. Carl Terry, Chairman of the BWRVIP], [an] LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of this FSER.

The staff noted that, in the applicant's response to RAI 4.2.6-1, the applicant provided an amended response to AAI No. 12 indicating that it had performed the applicable mean RT_{NDT} calculations for the limiting axial welds in the beltline region of the RPV (i.e., axial welds 2-307, A, B, and C), as based on the methodologies for performing ART calculations in RG 1.99, Revision 2, and BWRVIP-86, Revision 1-A, as modified by the mean RT_{NDT} calculation bases in the staff-approved version of the BWRVIP-05 report. The staff noted that the response to AAI No. 12 adequately summarized that the mean RT_{NDT} calculations demonstrated conformance with the mean RT_{NDT} value of 114 °F, as listed for BWR-4 RPV axial welds in the BWRVIP-05 report. Therefore, the staff finds that the applicant has adequately addressed the request in AAI No. 12 because the response adequately explains how the applicant has used the TLAA for RPV axial weld components to monitor neutron irradiation embrittlement in the RPV axial shell welds. The staff's concerns described in RAI 4.6.2-1 are resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the mean RT_{NDT} analysis for the RPV axial shell welds has been projected to the end of the period of extended operation. The staff also finds that the mean RT_{NDT} analysis meets the acceptance criteria in SRP-LR Section 4.2.2.1.5 because:

(a) The mean RT_{NDT} values reported for these welds at 52 EFPY were conservatively calculated with both the NRC's approved methodologies for performing ART (RT_{NDT}) calculations in RG 1.99, Revision 2, and BWRVIP-86, Revision 1-A (i.e., the methodology for performing RT_{NDT} calculations using applicable ISP data), as modified for mean RT_{NDT} calculation mean RT_{NDT} calculation bases in the NRC-approved version of the BWRVIP-05 report.

(b) The mean RT_{NDT} calculations demonstrate that mean RT_{NDT} values for the limiting axial shell welds in the RPV (welds 2-307 A, B, and C) are bounded by those values calculated in the limiting case study in the BWRVIP-05 report for RPV axial weld components.

(c) This demonstrates that the probability of failure value of $5x10^{-6}$ per reactor year (as reported in the BWRVIP-05 report) will remain bounding for the design of the RPV axial shell welds during the period of extended operation.

(d) The applicant has adequately addressed AAI No. 12 of the FSER for the BWRVIP-74-A report.

4.2.6.3 UFSAR Supplement

LRA Section A.2.1.6 provides the UFSAR supplement summarizing the TLAA evaluation of the mean RT_{NDT} calculations for the RPV axial weld components. The staff reviewed LRA Section A.2.1.6 consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer should verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.2.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA evaluation of the RPV axial welds, as required by 10 CFR 54.21(d).

4.2.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided, an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the mean RT_{NDT} analysis for the RPV axial welds has been adequately projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.7 Reactor Pressure Vessel Core Reflood Thermal Shock Analysis

4.2.7.1 Summary of Technical Information in the Application

LRA Section 4.2.7 describes the applicant's TLAA evaluation for the RPV core reflood thermal shock analysis. The LRA states that the UFSAR references GE Report NEDO-10029, "An Analytical Study on Brittle Fracture of GE-BWR Vessels Subject to the Design Basis Accident," dated June 1969, which addresses brittle fracture of the RPV due to reflood following a postulated LOCA. The LRA states that the thermal shock analysis in NEDO-10029 assumes a LOCA from a recirculation line break that is followed by LPCI. The LRA states that this thermal shock analysis accounts for the effects of neutron irradiation embrittlement at the end of 40 years of operation. The LRA also states that a later thermal shock analysis, “Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident,” was developed by Ranganath in August 1979 (ADAMS Legacy Library Accession No. 9110110105). The LRA states that the Ranganath analysis is bounding and that the maximum ART for the Fermi 2 RPV beltline materials is below the 400 °F temperature predicted at the time of peak stress intensity in the Ranganath analysis.

The applicant dispositioned the TLAA for RPV core reflood thermal shock in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.7.2 Staff Evaluation

The staff reviewed the applicant’s TLAA for the RPV core reflood thermal shock analysis and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the staff is to review the results of the revised analysis to verify that the evaluation period has been extended, such that the analysis is valid for the period of extended operation. SRP-LR Section 4.7.3.1.2 also states that the applicable analysis technique can be the one that is in effect in the plant’s CLB at the time that the LRA is filed. The staff reviewed the UFSAR and determined that NEDO-10029 represents the RPV core reflood thermal shock analysis that is currently in effect for Fermi 2. However, LRA Section 4.2.7 states that the applicant used the 1979 Ranganath analysis to project this TLAA to the end of the period of extended operation.

The staff noted that the 1979 Ranganath analysis was performed for a GE BWR-6 reactor design; however, the RPV at Fermi 2 is for a GE BWR-4 designed reactor. Therefore, the staff determined that the applicant had not demonstrated that the TLAA in LRA Section 4.2.7 is acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

By letter dated March 26, 2015, the staff issued RAI 4.2.7-1, Parts 1 and 2, requesting that the applicant address these issues. In RAI 4.2.7-1, Part 1, the staff asked the applicant to clarify which of the two RPV core reflood analyses (i.e., the NED0-10029 report or the 1979 Ranganath analysis) will be used for the period of extended operation. The staff also asked the applicant to identify the limit that is placed on the end-of-life neutron fluence value or end-of-life RT_{NDT} values in the report that will be relied upon for the period of extended operation and to identify whether the specific limit is based on the inside surface location, RPV base metal-to-clad interface location, or 1/4T location of the RPV. In RAI 4.2.7-1, Part 2, the staff requested the applicant to justify the basis for applying the 1979 Ranganath report to the licensing basis for Fermi 2 during the period of extended operation, if in response to Part 1 of the RAI, the 1979 Ranganath report will be the report that is relied upon for the period of extended option. As part of this response, the staff asked the applicant to demonstrate that the stress and neutron fluence levels assumed in the 1979 Ranganath analysis for the RPV in a BWR-6 reactor design are bounding for those that will apply to the BWR-4 RPV at Fermi 2 at the end of the period of extended operation (i.e., through 52 EFPY).

By letter dated April 27, 2015, the applicant provided its response to RAI 4.2.7-1, Parts 1 and 2. In its response to RAI 4.2.7-1, Part 1, the applicant clarified that the 1979 Ranganath analysis will be the RPV core reflood analysis of record for the period of extended operation. The applicant stated that the 1979 Ranganath analysis does not specifically calculate a limit for reference nil ductility transition temperature value (i.e., RT_{NDT} value) for the reflood analysis. Instead, the applicant explained that the analysis calculates the temperature distribution and thermal stress for the RPV and then establishes that the RPV wall temperature is high enough to ensure margin in the available fracture toughness at the time of maximum stress intensity after initiation of a postulated LOCA. The applicant discussed that the TLAA aspect of the evaluation uses the projected limiting RT_{NDT} value for the RPV, as adjusted for neutron fluence, to calculate the temperature at which the upper-shelf energy transition would occur. This temperature is compared to the RPV wall temperature at the time of maximum stress intensity established in the 1979 Ranganath analysis.

In its response to RAI 4.2.7-1, Part 2, the applicant stated that the 1979 Ranganath analysis was based on a 6-inch-thick BWR-6 vessel. The applicant stated that, in comparison, the thickness of the lower shell and lower-intermediate shell in the RPV are 7.125 inches and 6.125 inches, respectively. The applicant stated that the 1979 Ranganath analysis is applicable to the RPV at Fermi 2 because (a) the difference in temperature and thermal stresses at the 1/4T location between a 6-inch-thick BWR/6 vessel and vessel shells ranging from 6.125 inches to 7.125 inches in thickness is small, with wall thickness temperatures being slightly higher and wall thermal stresses being slightly lower for slightly thicker locations, and (b) the pressure stresses being higher for a thinner vessel, but near zero in a thermal shock event, which can then be neglected. The applicant also stated that the fluence levels and RT_{NDT} values used in the analysis have been projected to the end of the period of extended operation (i.e., to 52 EFPY) and are documented in the LRA Section 4.2.2. The applicant further stated that the results of the projected analysis demonstrate that there is significant margin in the RPV core reflood analysis during the period of extended operation.

The staff noted that the applicant amended LRA Section 4.2.7 to be consistent with clarifications made in its response to RAI 4.2.7-1, Parts 1 and 2. To assess the validity of the applicant's basis, the staff performed independent calculations of the 1/4T RT_{NDT} values for the plate components and weld components used in the fabrication of the RPV. The staff calculated a limiting RT_{NDT} value of 87.2 °F for the limiting components in the RPV, which are the lower shell axial welds (welds 2-307, A, B, and C) that were made from weld heat 13253/12008 using a Linde 1092 weld flux. The staff noted that this is the same value as that calculated by the applicant for these limiting welds. The staff also noted that the RPV core reflood analysis uses the more conservative temperature at which upper-shelf transition occurs based on the ART value (i.e., 206 °F) that bounds the most limiting 1/4T ART (1/4 RT_{NDT}) value calculated for the components at 52 EFPY. The staff noted that this provides sufficient demonstration that the projected RT_{NDT} value used in the analysis is bounded by the RPV wall temperature value (400 °F) used in the RPV core reflood analysis (i.e., in the 1979 Ranganath analysis).

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii) that the RPV core reflood analysis has been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the applicant has projected the limiting RT_{NDT} value for the RPV to the end of the period of extended operation (i.e., to 52 EPFY) and has demonstrated that the analysis remains acceptable when compared to limiting temperature acceptance criterion in the RPV core reflood analysis that will be applied to the period of extended operation (i.e., for the 1979 Ranganath analysis). The staff's concerns described in RAI 4.2.7-1, Parts 1 and 2 are resolved.

4.2.7.3 UFSAR Supplement

LRA Section A.2.1.7 provides the UFSAR supplement summarizing the applicant's TLAA evaluation for the RPV core reflood thermal shock analysis. The staff reviewed LRA Section A.2.1.7 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the applicant is to provide a summary description for its evaluation of each TLAA. The SRP-LR also states that the summary description should contain information on the disposition of the TLAA for the period of extended operation and be appropriate such that later changes can be controlled by 10 CFR 50.59, "Changes, Tests, and Experiments."

Based on its review of the UFSAR supplement, as amended by the letter dated April 27, 2015, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address RPV core reflood thermal shock, as required by 10 CFR 54.21(d).

4.2.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for RPV core reflood thermal shock has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3 Metal Fatigue

LRA Section 4.3 contains the fatigue analyses for Class 1 and non-Class 1 mechanical components. LRA Section 4.3 provides the applicant's analyses of the following areas:

- Class 1 fatigue analyses
- non-Class 1 fatigue analyses
- effects of reactor water environment on fatigue life

4.3.1 Class 1 Fatigue Analyses

LRA Section 4.3.1, as revised by the LRA annual update dated June 26, 2015, introduces the applicant's metal fatigue TLAAs for Class 1 components. The LRA states that the fatigue analyses performed during the design phase of the Class 1 components were based on the assumed number of plant transients for a 40-year operating life. Extending the period of operation for these components from 40 to 60 years results in the fatigue evaluations being TLAAs. The applicant stated that it reviewed the transient cycles that are required to be tracked for fatigue evaluations and confirmed the current cycle counts. The cycle counts were linearly extrapolated to determine a projected count at 60 years of operation. The current, projected, and analyzed cycle counts are provided in LRA Table 4.3-1, "Analyzed Transients with Projections," as modified by letter dated May 9, 2016. The LRA states that the Fatigue Monitoring Program is being used to ensure that the number of cycles experienced by a component does not exceed its design limit.

During the staff's review of LRA Section 4.3.1, it was noted that Table 4.3-1 lists some events being tracked that are not design transients. It was also unclear to the staff which events were being used to calculate the CUFs for the TLAAs described in the LRA Section 4.3.1

subsections. By letter dated January 14, 2015, the staff issued RAI 4.3.1-1 requesting that the applicant clearly distinguish between events that are design transients and those that are not design transients in Table 4.3-1. The staff also requested that the applicant clarify which transients are being used to calculate the CUFs for each LRA Section 4.3.1 subsection.

In its response dated February 12, 2015, the applicant stated that the only event listed in LRA Table 4.3-1 that is not a design transient is the "Main steam bypass line time of operation at 30% - 45% open (days)," which is used in a vibration-based service life evaluation. The Fatigue Monitoring Program was enhanced (Enhancement 5 in SER Section 3.0.3.2.8) to track this event. The applicant's response also included a description of which transients are being used to calculate the CUFs for components in each LRA Section 4.3.1 subsection. The staff finds the applicant's response acceptable because it clearly identified a transient event listed in LRA Table 4.3-1 that is not a design transient and clarified that the Fatigue Monitoring Program will be enhanced to track this transient. The response also provided traceability between events in LRA Table 4.3-1 and TLAAs that use these events as cycle inputs. The staff's concern described in RAI 4.3.1-1 is resolved.

The staff notes that the projected 60-year number of cycles for each event is less than the corresponding analysis input value, and the applicant's Fatigue Monitoring Program is used to track transient cycles and requires corrective actions if the numbers of cycles approach analyzed values. The staff's evaluation of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8.

LRA Section 4.3.1 provides the applicant's analyses of the following areas:

- RPV
- RPV feedwater nozzles
- reactor vessel underclad cracking
- RPV internals
- reactor recirculation pumps
- Class 1 piping

4.3.1.1 Reactor Pressure Vessel

4.3.1.1.1 Summary of Technical Information in the Application

LRA Section 4.3.1.1, as revised by the LRA annual updates dated June 26, 2015, and May 9, 2016, describes the applicant's TLAA for the RPV cumulative fatigue damage. The RPV is a cylindrical pressure vessel with hemispherical heads. Design data for the RPV are provided in UFSAR Table 5.4-1, "Reactor Pressure Vessel Design Data." LRA Table 4.3-1 provides the transients that contribute to cumulative fatigue damage that are tracked by the Fatigue Monitoring Program. LRA Table 4.3-2, "Reactor Pressure Vessel Cumulative Usage Factors," as revised by letter dated May 9, 2016, provides the CUFs for the RPV locations.

The applicant dispositioned the TLAAs for the RPV closure region, RPV closure studs, RPV shell, bottom head support skirt, steam outlet nozzles, feedwater nozzles, core spray nozzles, control rod drive (CRD) return nozzle, recirculation outlet nozzles, recirculation inlet nozzles, core ΔP nozzle, CRD nozzles, basin seal skirt, shroud support, 4-inch vent nozzle bolts, 6-inch instrument/head spray nozzle bolts, and CRD assembly in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of cumulative fatigue damage 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 RPV components listed in LRA Table 4.3-2 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 state that the applicant may use GALL Report AMP X.M1, "Fatigue Monitoring," to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii). The SRP-LR also states that the reviewer verifies that the applicant has stated that GALL Report AMP X.M1 is applicable to its program that monitors and tracks the number of transients for the relevant components. The staff noted that the applicant's response to RAI 4.3.1-1, by letter dated February 12, 2015, included a description of which transients in LRA Table 4.3-1 are being used to calculate the CUFs in LRA Table 4.3-2. The staff's evaluation of RAI 4.3.1-1 is documented in SER Section 4.3.1 above. The staff finds that the current and projected cycle counts associated with the RPV in LRA Table 4.3-1 are bounded by the number of analyzed cycles.

The staff noted that the applicant is managing the effects of cumulative fatigue damage on the intended functions of the applicable components using the Fatigue Monitoring Program. The staff's review of the Fatigue Monitoring Program is in SER Section 3.0.3.2.8. The staff review of the program concludes that the elements of the Fatigue Monitoring Program are consistent with the corresponding program elements of GALL Report AMP X.M1.

The staff finds that the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of the RPV components listed in LRA Table 4.3-2 will be adequately managed for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant's Fatigue Monitoring Program is consistent with GALL Report AMP X.M1, which can be used to accept a TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.1.3 UFSAR Supplement

LRA Section A.2.2.1, as revised by the LRA annual update dated June 26, 2015, provides the UFSAR supplement summarizing the RPV TLAA that evaluates cumulative fatigue damage. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the review verifies that the applicant has provided a summary description of the evaluation for the RPV TLAA to be included in the UFSAR supplement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address cumulative fatigue damage of the RPV, 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 cumulative fatigue damage on the intended functions of the RPV components listed in LRA Table 4.3-2 will be adequately managed by the Fatigue Monitoring Program for the period of extended operation.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.2 Reactor Pressure Vessel Feedwater Nozzles

4.3.1.2.1 Summary of Technical Information in the Application

LRA Section 4.3.1.2 describes the applicant's TLAA evaluations for the feedwater nozzle fracture mechanics analysis and feedwater nozzle fatigue due to rapid cycling. The LRA states that a plant-specific fracture mechanics analysis was completed for the feedwater nozzles as part of the applicant's review of NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," dated November 1980. From this analysis, it was determined that a total of 620 startup and shutdown transients plus scram transients would cause a postulated crack to grow from 0.25 inch to the limit of 1 inch. The LRA states that the projected number of these transients through the period of extended operation is less than the total number of transients that were analyzed.

The applicant dispositioned the TLAA for the feedwater nozzle fracture mechanics analysis in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

The LRA states that the fatigue analysis for the feedwater nozzles accounts for potential rapid cycling behind the thermal sleeves. The LRA states that this rapid cycling contributes to the fatigue usage at this location, and it is calculated based on time and feedwater temperature.

The applicant dispositioned the TLAA for feedwater nozzle fatigue due to rapid cycling behind the thermal sleeves in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of cracking on the intended functions of the feedwater nozzles will be adequately managed for the period of extended operation.

4.3.1.2.2 Staff Evaluation

Fracture Mechanics Analysis. The staff reviewed the applicant's TLAA for the feedwater nozzle fracture mechanics analysis and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.3.3.1.5.1. The SRP-LR states that the staff is to review the operating cyclic experience and a list of the assumed cycles used in the existing analysis to ensure that the number of assumed cycles would not be exceeded during the period of extended operation.

LRA Section 4.3.1.2 states that the fracture mechanics analysis for the feedwater nozzles was completed as part of the NUREG-0619 review. The staff published NUREG-0619 to address cracking that had occurred in the feedwater nozzles of several BWRs in the late 1970s. The report discusses various solutions to the cracking problem, which include system modifications and changes to operating procedures to decrease the magnitude and frequency of temperature fluctuations that had led to the cracking. One potential system modification was the implementation of a low-flow feedwater controller that met certain characteristics. As a followup to NUREG-0619, on February 29, 1981, the staff issued GL 81-11, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking (NUREG-0619)," dated February 29, 1981. GL 81-11 notes that there was some difficulty in implementing low-flow feedwater controllers that met all of the recommended characteristics. As an alternative, GL 81-11 states that the staff would accept the use of feedwater controllers that did not meet all of the recommended characteristics, provided that a plant-specific fracture mechanics analysis was submitted to demonstrate that the stresses from conservative controller temperature and flow profiles, when added to those resulting from the other crack growth phenomena, such as startup and shutdown cycles, did not result in the growth of a crack to greater than 1 inch for the 40-year life of the plant.

The staff's review noted that the applicant had submitted an initial plant-specific fracture mechanics analysis for the Fermi 2 feedwater nozzles by letter dated November 22, 1989 (ADAMS Legacy Library Accession No. 8912040089). An updated analysis, documented in GE Report GE-NE-523-22-0292, "Updated NUREG-0619 Feedwater Nozzle Fatigue Crack Growth Analysis, Enrico Fermi Nuclear Power Plant, Unit 2," was later submitted by letter dated July 29, 1992 (ADAMS Legacy Library Accession No. 9208030210). Because this updated analysis only demonstrated that a postulated 0.25-inch crack would grow to 1 inch in 38.3 years – a result that did not meet the acceptance standard in GL 81-11 – the staff requested the applicant to submit additional information to confirm the results of the updated analysis. By letter dated June 24, 1998 (ADAMS Legacy Library Accession No. 9806300462), the applicant provided this confirmatory information in Design Calculation 5922, "NUREG-0619 RPV Feedwater Nozzle Crack Growth Reevaluation." The analysis in Design Calculation 5922 is based on additional plant thermal cycle data, which was used to update the 40-year transient projections for the fracture mechanics analysis. At that time, 180 startup and shutdown transients and 316 scram transients were projected, for a total of 496 transients. Using the crack depth curve in Figure 6-1 of GE-NE-523-22-0292, the applicant determined that 496 transients would grow the postulated crack from 0.25 inch to 0.8 inch in 40 years. In an SE dated August 5, 1998 (ADAMS Legacy Library Accession No. 9808199327), the staff found this analysis to be acceptable because the calculated crack depth was less than 1 inch in 40 years, and therefore it met the acceptance standard in GL 81-11. Accordingly, the applicant's fracture mechanics analysis is relied upon to justify continued use of its feedwater controller.

Consistent with the guidance in SRP-LR Section 4.3.3.1.5.1, the staff reviewed the list of assumed transients used in the fracture mechanics analysis. The staff determined that there are two types of assumed transients: (1) startup and shutdown and (2) scram. The staff confirmed that both of these transient types are identified in the applicant's TLAA evaluation along with projections for the period of extended operation. LRA Section 4.3.1.2 states that transient numbers 3 and 15-17 in LRA Table 4.3-1 reflect the startup and shutdown transients, and transient numbers 10 and 11 reflect the scram transients. Based on its reviews of GE-NE-523-22-0292 and Design Calculation 5922, the staff determined that power reductions were also counted as scram transients. In particular, Design Calculation 5922 states that power reductions to below 50 percent power were counted as scrams. LRA Table 4.3-1 states that transient number 10 is for "SCRAM – turbine generator trip" and transient number 11 is for "SCRAM – all others." However, based on this information, the staff could not determine whether the projections for transient numbers 10 and 11 also include power reductions to below 50 percent power.

By letter dated January 26, 2015, the staff issued RAI 4.3.1.2-1, requesting that the applicant indicate whether such power reductions are included in transient numbers 10 and 11 in LRA Table 4.3-1. The staff also requested that the applicant provide justification if these power reductions were not included in the transient projections.

In its response dated March 5, 2015, the applicant stated that the power reductions to below 50 percent of power are counted as either Event No. 8 (loss of feedwater heater – turbine trip with 100 percent bypass), 9 (loss of feedwater heaters – partial feedwater heater bypass), or 11

(LRA Table 4.3-1, SCRAM – all others), depending on the lowest reactor power and feedwater temperature achieved during the event. The applicant stated that a significant contributor to feedwater nozzle crack growth is low-flow feedwater control. At 20 percent power, feedwater flow in the reactor water cleanup (RWCU) return loop is an order of magnitude larger than RWCU flow. Therefore, feedwater flow changes at or above 20 percent power have much less effect on "RWCU + Feedwater" temperature and the nozzle transient for this event is limited to a single cycle of slow temperature and flow change associated with the power change. The applicant also stated that it was conservative to count these power reduction events as scram events.

The staff reviewed the applicant's response and finds it acceptable because it provided a technical basis for how the transient is counted and that, at or above 20 percent power, feedwater flow changes have much less effect on the transient. In addition, the applicant counted the power reduction events conservatively as scram events or loss of feedwater heater events. The staff's concern described in RAI 4.3.1.2-1 is resolved.

Following the guidance in SRP-LR Section 4.3.3.1.5.1, the staff also reviewed the applicant's transient projections against the total number of transients that were assumed in the existing analysis. LRA Section 4.3.1.2 states that a total of 620 transients were assumed in the existing analysis. However, the staff reviewed GE Report GE-NE-523-22-0292 and determined that its calculations are based on a total of 648 transients. Also, as previously stated, the results of these calculations did not meet the acceptance standard in GL 81-11. In addition, the staff reviewed Design Calculation 5922 and determined that its calculations, which did meet the acceptance standard in GL 81-11, are based on a projected total of 496 transients. Since neither of these existing calculations were based on a total of 620 transients, it was not clear to the staff why the applicant compared its transient projections for this TLAA against this value to demonstrate that the analysis remains valid for the period of extended operation.

By letter dated January 26, 2015, the staff issued RAI 4.3.1.2-2 requesting that the applicant show how the existing fracture mechanics analysis is based on a total of 620 transients. Alternatively, the staff requested the applicant to demonstrate that the projections for startup and shutdown transients plus scram transients, inclusive of power reductions to below 50 percent power, are less than the 496 transients that were used in Design Calculation 5922. Otherwise, the staff requested that the applicant provide and justify a different demonstration for this TLAA pursuant to 10 CFR 54.21(c)(1).

In its response dated March 5, 2015, the applicant stated that GE Report GE-NE-523-22-0292 is based on a total of 648 startup, shutdown, and scram transient event occurrences, at a rate of 16.2 events per year for 40 years. Because this number of occurrences results in the postulated 0.25-inch flaw growing to a size greater than the acceptance limit of 1 inch, GE Report GE-NE-523-22-0292 determined that the postulated 0.25-inch flaw would grow to 1 inch in 38.3 years (or 620 transient event occurrences). The applicant also stated that it performed a design calculation, DC-5922, which evaluated Fermi 2's history of startup, shutdown, and scram transient events subsequent to GE Report GE-NE-523-22-0292 to show that the projection of 648 events per 40 years in GE-NE-523-22-0292 was conservative; DC-5922 projected 496 transient event occurrences for a 40-year operating period. For license renewal, projections of transient event occurrences for 60 years of operation are based on the information from LRA Table 4.3-1, in which the sum of the occurrences for Events Nos. 3, 10, 11, and 15-17 is a total of 566 transients, which is still less than the 620 transient events necessary to grow a postulated crack from 0.25 inch to 1 inch.

The staff reviewed the applicant's response and finds it acceptable because the applicant performed an analysis of the postulated flaw for the period of extended operation (for the 60 years of operation), and the analysis shows that all the applicable events conservatively add up to a total of 566 events, which is less than the 620 transient events necessary to grow a postulated crack from 0.25 inch to 1 inch. The staff's concern described in RAI 4.3.1.2-2 is resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the feedwater nozzle fracture mechanics analysis remains valid for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.5.1 because the applicant demonstrated that the number of transient cycles assumed for the 40-year life would not be exceeded during the period of extended operation.

Fatigue due to Rapid Cycling. The staff reviewed the applicant's TLAA for the feedwater nozzle cumulative fatigue damage due to rapid cycling 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 state that the applicant may use GALL Report AMP X.M1, "Fatigue Monitoring," to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii). The SRP-LR also states that the reviewer verifies that the applicant has stated that GALL Report AMP X.M1 is applicable to its program that monitors and tracks the number of transients for the relevant components. The applicant's response to RAI 4.3.1-1, by letter dated February 12, 2015, includes a description of which transients in LRA Table 4.3-1 are being used to calculate the CUFs in LRA Table 4.3-2 for the feedwater nozzles. The staff's evaluation of RAI 4.3.1-1 is documented in SER Section 4.3.1. The staff noted that the current and projected cycle counts associated with the feedwater nozzle in LRA Table 4.3-1 are bounded by the number of analyzed cycles.

The staff noted that the applicant is managing the effects of cumulative fatigue damage on the intended functions of the feedwater nozzles using the Fatigue Monitoring Program. The staff's review of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8. The staff's review of the program concludes that the elements of the Fatigue Monitoring Program are consistent with the corresponding program elements of GALL Report AMP X.M1.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to rapid cycling on the intended functions of the feedwater nozzles will be adequately managed for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant's Fatigue Monitoring Program is consistent with GALL Report AMP X.M1.

4.3.1.2.3 UFSAR Supplement

LRA Section A.2.2.1, as revised by the LRA annual update dated June 26, 2015, provides the UFSAR supplement summarizing the applicant's TLAA evaluations for the feedwater nozzle fracture mechanics and fatigue due to rapid cycling analyses. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAAs.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the feedwater nozzle fracture mechanics and fatigue due to rapid cycling analyses, 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)(i), that the feedwater nozzle fracture mechanics analysis remains valid for the period of extended operation. The staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to rapid cycling on the intended functions of the feedwater nozzles will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluations, as required by 10 CFR 54.21(d).

4.3.1.3 Reactor Vessel Underclad Cracking

4.3.1.3.1 Summary of Technical Information in the Application

LRA Section 4.3.1.3 states that there is no TLAA associated with reactor vessel underclad cracking at Fermi 2.

4.3.1.3.2 Staff Evaluation

The staff noted that SRP-LR Table 3.1-1, item 3.1.1-18, identifies this plant-specific TLAA as applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because an evaluation of a TLAA for the reactor vessel underclad cracking is only applicable to PWRs and Fermi 2 is a BWR.

4.3.1.3.3 UFSAR Supplement

The staff concludes that an UFSAR supplement is not required because this TLAA is not applicable to BWRs.

4.3.1.3.4 Conclusion

On the basis of its review, the staff concludes that this TLAA is not applicable to Fermi 2 and a UFSAR supplement is not required.

4.3.1.4 Reactor Pressure Vessel Internals

4.3.1.4.1 Summary of Technical Information in the Application

LRA Section 4.3.1.4, as revised by the LRA annual update dated June 26, 2015, describes the applicant's TLAA for RPV internals that evaluates cumulative fatigue damage. The RPV internals consist primarily of the core, core support structure, steam dryer assembly, and jet pumps. LRA Table 4.3-1 provides the transients that contribute to cumulative fatigue damage that are tracked by the Fatigue Monitoring Program. LRA Table 4.3-3, "RPV Internals Cumulative Usage Factors," provides the CUFs for the locations that are subject to an AMR.

The applicant dispositioned the TLAAs for the RPV internals (core spray lines, jet pump riser braces, access hole covers, jet pump auxiliary spring wedges, and feedwater sparger) in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of cumulative fatigue damage 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 RPV internals 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 state that the applicant may use GALL Report AMP X.M1, “Fatigue Monitoring,” to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii). The SRP-LR also states that the reviewer verifies that the applicant has stated that GALL Report AMP X.M1 is applicable to its program that monitors and tracks the number of transients for the relevant components. The staff noted that the applicant’s response to RAI 4.3.1-1, by letter dated February 12, 2015, includes a description of which transients in LRA Table 4.3-1 are being used to calculate the CUFs in LRA Table 4.3-3. The staff’s evaluation of RAI 4.3.1-1 is documented in SER Section 4.3.1. The staff noted that the current and projected cycle counts associated with the RPV internals in LRA Table 4.3-1 are bounded by the number of analyzed cycles.

The staff noted that the applicant is managing the effects of cumulative fatigue damage on the intended functions of the applicable components using the Fatigue Monitoring Program. The staff’s review of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8. The staff review of the program concludes that the elements of the Fatigue Monitoring Program are consistent with the corresponding program elements of GALL Report AMP X.M1.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of the RPV internals will be adequately managed for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant’s Fatigue Monitoring Program is consistent with GALL Report AMP X.M1.

4.3.1.4.3 UFSAR Supplement

LRA Section A.2.2.1, as revised by the LRA annual update dated June 26, 2015, provides the UFSAR supplement summarizing the RPV internals cumulative fatigue damage TLAAs. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the review verifies that the applicant has provided a summary description of the evaluation for the TLAA to be included in the UFSAR supplement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address cumulative fatigue damage of the RPV internals, 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 cumulative fatigue damage on the intended functions of the RPV internals (core spring lines, jet pump riser braces, access hole covers, jet pump auxiliary spring wedges, and feedwater sparger) will be adequately managed by the Fatigue Monitoring Program for the period of extended operation.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.5 Reactor Recirculation Pumps

4.3.1.5.1 Summary of Technical Information in the Application

LRA Section 4.3.1.5, as revised by the LRA annual update dated June 26, 2015, and May 9, 2016, describes the applicant's TLAA for the cumulative fatigue damage of the reactor recirculation pumps. The details of the construction and design of the reactor recirculation pumps are provided in UFSAR Table 3.2-1, "Structures, Systems, and Components Classification," and Table 3.2-4, "Code Status of Class I (A) Primary Pressure Boundary Components." UFSAR Table 3.9-20, "Recirculation Pumps," provides representative analyses of the recirculation pumps. LRA Table 4.3-1, as modified by letter dated May 9, 2016, provides the events that contribute to cumulative fatigue damage that are tracked by the Fatigue Monitoring Program. LRA Table 4.3-4, "Reactor Recirculation Pumps Cumulative Usage Factors," as modified by letter dated May 9, 2016, provides the CUFs for the locations that are subject to an AMR.

The applicant dispositioned the TLAA for the reactor recirculation pumps in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of cumulative fatigue damage 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 reactor recirculation pumps 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 state that the applicant may use GALL Report AMP X.M1, "Fatigue Monitoring," to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii). The SRP-LR also states that the review verifies that the applicant has stated that GALL Report AMP X.M1 is applicable to its program that monitors and tracks the number of transients for the relevant components. The staff noted that the applicant's response to RAI 4.3.1-1, by letter dated February 12, 2015, includes a description of which transients in LRA Table 4.3-1 are being used to calculate the CUFs in LRA Table 4.3-4. The staff's evaluation of RAI 4.3.1-1 is documented in SER Section 4.3.1. The current and projected cycle counts associated with the reactor recirculation pumps in LRA Table 4.3-1, as modified by letter dated May 9, 2016, are bounded by the number of analyzed cycles provided in the LRA.

The staff noted that the applicant is managing the effects of cumulative fatigue damage on the intended functions of the reactor recirculation pumps using the Fatigue Monitoring Program. The staff's review of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8. The staff's review of the program concludes that the elements of the Fatigue Monitoring Program are consistent with the corresponding program elements of GALL Report AMP X.M1.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of the reactor recirculation pumps will be adequately managed for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant's Fatigue Monitoring Program is consistent with GALL Report AMP X.M1.

4.3.1.5.3 UFSAR Supplement

LRA Section A.2.2.1, as revised by the LRA annual update dated June 26, 2015, provides the UFSAR supplement summarizing the TLAA for the cumulative fatigue damage of the reactor recirculation pumps. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the reviewer verifies that the applicant has provided a summary description of the evaluation for the TLAA to be included in the UFSAR supplement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address cumulative fatigue damage of the reactor recirculation pumps, 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 cumulative fatigue damage on the intended functions of the reactor recirculation pumps will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.6 Class 1 Piping

4.3.1.6.1 Summary of Technical Information in the Application

LRA Section 4.3.1.6, as revised by the LRA annual update dated June 26, 2015, describes the applicant's TLAA for the cumulative fatigue damage of Class 1 piping. The LRA states that fatigue analyses were performed on multiple locations for each system within the Class 1 boundary. The Class 1 piping is denoted in the drawing listed in LRA Table 4.3-5, "LRA Drawings for Class 1 Piping." LRA Table 4.3-1 provides the transient events that contribute to cumulative fatigue damage and are tracked by the Fatigue Monitoring Program. The CUFs for the most limiting piping location and associated valves are provided in LRA Tables 4.3-6, "Piping Cumulative Usage Factors," and 4.3-7, "Valve Cumulative Usage Factors."

The applicant dispositioned the TLAAs for the Class 1 piping and associated valves in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of cumulative fatigue damage 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 Class 1 piping and associated valves 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 state that the applicant may use GALL Report AMP X.M1, "Fatigue Monitoring," to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii). The SRP-LR also states that the review verifies that the applicant has stated that GALL Report AMP X.M1 is applicable to the program that monitors and tracks the number of transients for the relevant components at the site. The staff noted that the applicant's response to RAI 4.3.1-1, by letter dated February 12, 2015, includes a description of which transients in LRA Table 4.3-1 are being used to calculate the CUFs in LRA Tables 4.3-6 and 4.3-7. The staff's review of RAI 4.3.1-1 is documented in SER Section 4.3.1. The current and projected cycle counts associated with the Class 1 piping in LRA Table 4.3-1 are bounded by the number of analyzed cycles.

The staff noted that the applicant is managing the effects of cumulative fatigue damage on the intended functions of the applicable components using the Fatigue Monitoring Program. The staff's review of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8. The staff's review of the program concludes that the elements of the Fatigue Monitoring Program are consistent with the corresponding program elements of GALL Report AMP X.M1.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of the Class 1 piping and associated values will be adequately managed for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant's Fatigue Monitoring Program is consistent with GALL Report AMP X.M1.

4.3.1.6.3 UFSAR Supplement

LRA Section A.2.2.1, as revised by the LRA annual update dated June 26, 2015, provides the UFSAR supplement summarizing the TLAAs for the cumulative fatigue damage of Class 1 piping. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the reviewer verifies that the applicant has provided a summary description of the evaluation for the TLAA to be included in the UFSAR supplement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address cumulative fatigue damage of the Class 1 piping, 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 cumulative fatigue damage on the intended functions of the Class 1 piping and associated valves will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2 Non-Class 1 Fatigue Analyses

4.3.2.1 Piping and In-Line Components

4.3.2.1.1 Summary of Technical Information in the Application

LRA Section 4.3.2.1 describes the applicant's TLAA for fatigue of the non-Class 1 piping and in-line components. The LRA states that the in-scope non-Class 1 piping is built to ASME Code Section III Class 2, ASME Code Section III Class 3, or ANSI B31.1. Implicit fatigue-based maximum allowable stress calculations were performed on these components. The individual system evaluations indicate that 7,000 thermal cycles will not be exceeded during the period of extended operation and a stress range reduction factor of 1.0 is used in the stress analysis.

The LRA also states that plant heatups and cooldowns limit many of the system's thermal cycles and that the number of plant heatups and cooldowns are significantly below 7,000, as shown in LRA Table 4.3-1.

The applicant dispositioned the TLAAs for the non-Class 1 piping and in-line components in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the fatigue analyses remain valid for the period of extended operation.

4.3.2.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the 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 state that the relevant information in the TLAA is reviewed to verify that the maximum allowable stress range values remain valid. The SRP-LR also states that the reviewer verifies that the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.

LRA Section 4.3.2.1 states that none of the TLAAs associated with non-Class 1 piping within the scope of license renewal will exceed the thermal cycle limit of 7,000 cycles during the period of extended operation. The LRA further states that for many plant systems the number of thermal cycles coincides with the number of plant heatups and cooldowns; however, the number of thermal cycles is independent of plant heatups and cooldowns for other systems. The staff noted that the LRA does not provide the transients, current cycle count, and projected cycle count being used to determine that the thermal cycle limit of 7,000 will not be exceeded during the period of extended operation. By letter dated January 14, 2015, the staff issued RAI 4.3.2-1 requesting that the applicant provide the transients (or cycles) being counted that are used to determine that the stress calculations are valid for the period of extended operation and the projected number of full thermal cycles for the non-Class 1 piping TLAAs being evaluated.

In its response dated February 12, 2015, the applicant provided a summary of the cycles being counted for each system and the estimated number of cycles projected out to 60 years for each system. The applicant stated that the number of cycles for many of the components is limited by those in LRA Table 4.3-1. The number of cycles for the remaining locations is related to system-specific operations. The applicant stated that the estimated total number of cycles provided for each in-scope system are all considerably below the limit of 7,000 cycles.

The staff finds the applicant's response acceptable because (a) the applicant clarified what cycles are being counted as part of the analyses, (b) the applicant provided the estimated number of cycles at 60 years of operation, and (c) the estimated number of cycles are all within an allowable limit. The staff's concern described in RAI 4.3.2-1 is resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analyses for the non-Class 1 piping and in-line components remain valid for the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 since the maximum allowable stress range values for the existing fatigue analysis remain valid because the allowable limit for the number of full thermal cycles does not exceed the 7,000 limit during the period of extended operation.

4.3.2.1.3 UFSAR Supplement

LRA Section A.2.2.2 provides the UFSAR supplement summarizing the TLAA for the cumulative fatigue damage of the 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 state that the reviewer verifies that the applicant has provided a summary description of the evaluation for the TLAA to be included in the UFSAR supplement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address cumulative fatigue damage of the non-Class 1 piping and in-line components, as required by 10 CFR 54.21(d).

4.3.2.1.4 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)(i), that the cumulative fatigue analyses for the non-Class 1 piping and in-line components remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2.2 Components Other Than Piping

4.3.2.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2.2 describes the applicant's TLAAs for fatigue of non-Class 1 components other than piping. The LRA states that a review of the in-scope non-Class 1 components, other than piping, identified TLAAs associated with the fatigue analyses of expansion joints and flexible connections. The analyses assumed a bounding number of fatigue cycles. The LRA also states that the assumed number of fatigue cycles remains bounding for 60 years of operation.

The applicant dispositioned the TLAAs for the non-Class 1 components other than piping in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the fatigue 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 non-Class 1 components, other than piping, and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the applicable review procedures in SRP-LR Section 4.3.3.1.2.1, which state that the reviewer verifies that the maximum allowable stress range values for the existing fatigue analysis remain valid for the period of extended operation and that the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.

LRA Section 4.3.2.2 states that the non-Class 1 components, other than piping, were analyzed and determined to remain valid for the period of extended operation. However, the staff lacked sufficient details regarding how this determination was made. By letter dated January 14, 2015, the staff issued RAI 4.3.2-2 requesting that the applicant provide a summary of the analysis used to evaluate these components. The staff requested that the summary include the code that the components were designed to, transients being counted for the fatigue analyses, projected number of cycles, and number of bounding cycles.

In its response dated February 12, 2015, the applicant stated that the expansion joints and flexible connections are designed in accordance with Expansion Joint Manufacturers Association, Inc., standards for fatigue or tested in accordance with ASME Section III NC-3649.4(e)(2)(b) to establish the allowable number of fatigue cycles. The response also included Table 4.3.2-2a, "Expansion Joints with TLAAs." This table identifies the expansion joints with TLAAs and the applicable system in which they reside. Table 4.3.2-2a also includes the cycles counted for the fatigue analyses, projected number of cycles for 60 years of operation, and the bounding number of cycles for each component. The projected number of cycles for 60 years of operation are all considerably below the bounding number of cycles.

The staff finds the applicant's response acceptable because the applicant (1) provided the pertinent details of the fatigue analyses, (2) demonstrated that the number of allowable thermal cycles, which bounds the fatigue analyses, is determined by either testing or design analyses in accordance with applicable industrial standards, and (3) provided the bounding number of cycles and projected number of cycles that illustrate that the analyses remain valid for 60 years of operation. The staff's concern described in RAI 4.3.2-2 is resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analyses for the non-Class 1 components, other than piping, remain valid for the period of extended operation. Additionally, the analysis meets the applicable acceptance criteria in SRP-LR Section 4.3.2.1.2.1 and the projected numbers of cycles do not exceed the bounding limit during the period of extended operation.

4.3.2.2.3 UFSAR Supplement

LRA Section A.2.2.2 provides the UFSAR supplement summarizing the TLAAs for fatigue of the non-Class 1 components, other than piping. 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 a summary description of the evaluation for the TLAA to be included in the UFSAR supplement.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address fatigue of the non-Class 1 components, other than piping, 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 on the intended functions of the non-Class 1 components, other than piping, remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 Effects of Reactor Water Environment on Fatigue Life

4.3.3.1 Summary of Technical Information in the Application

LRA Section 4.3.3, as revised by the LRA annual updates dated June 26, 2015, and May 9, 2016, describes the applicant's evaluation for the effects of environmentally assisted fatigue (EAF) due to the reactor water environment on the fatigue life of pressure boundary components for the period of extended operation. The LRA states that all ASME Class 1 RPV boundary locations that are wetted, including the six locations identified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," were reviewed as part of the screening process for evaluating environmental effects on fatigue. The EAF correction factors (F_{en}) and EAF CUF values (CUF_{en}) for these locations were calculated using the formulas and fatigue curves in NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials." The LRA also states that an evaluation of the water chemistry history, based on normal water chemistry, hydrogen water chemistry, and on-line noble metal chemistry information, was used to determine the dissolved oxygen (DO) levels. The LRA further states that guidance in NUREG/CR-6909 was used for location screening and the methodology to determine the bounding locations is based on industry guidance. LRA Table 4.3-8, "EAF Screening of Fermi 2 Locations," as revised by letters dated January 22, 2016, and May 9, 2016, provides the F_{en} factors and associated CUF_{en} values for the screening locations and identifies the bounding locations, referred to as sentinel locations.

The applicant dispositioned the evaluation for the ASME Class 1 wetted RPV boundary locations in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of EAF on the intended functions will be adequately managed by the Fatigue Monitoring Program for the period of extended operation.

4.3.3.2 Staff Evaluation

The staff reviewed the applicant's evaluation for the effects of the reactor water environment on fatigue life 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 state that the reviewer verifies that the applicant has addressed the staff recommendation for the closure of GSI-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life," dated December 26, 1999. The SRP-LR also states that the review verifies that the applicant has identified high fatigue usage locations for evaluation, including those in NUREG/CR-6260, and evaluated these locations by applying environmental correction factors to the existing CUFs using the appropriate formulae in NUREG/CR-6909, NUREG/CR-5704, and/or NUREG/CR-6583. The review procedures in SRP-LR Section 4.3.3.1.1.3 for analysis based on CUF calculations states that the applicant may use GALL Report AMP X.M1, "Fatigue Monitoring," to accept a TLAA in accordance with 10 CFR 54.21(c)(1)(iii), as applicable. GALL Report AMP X.M1 is applicable to EAF evaluations. The staff noted that Commission Order No. CLI-10-17, dated July 8, 2010 (ADAMS Accession No. ML131890775), indicates that 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. However, the staff will review the EAF evaluation in a similar manner as a TLAA evaluation.

LRA Section 4.3.3 states that an EAF screening has been conducted on all wetted ASME Class 1 RPV boundary locations and that the results of the screening calculations were used to determine the bounding locations. The LRA states that when the screening produced a CUF_{en}

value exceeding the limit of 1.0, the locations were re-evaluated using average load pair temperatures or average transient temperatures when available. The results of the screening evaluation are provided in LRA Table 4.3-8 with four locations having projected CUF_{en} values exceeding the limit of 1.0. The LRA also states that the fatigue usage calculations will be updated using refined fatigue analysis to determine valid CUF_{en} values of less than 1.0 for the locations in Table 4.3-8. The LRA originally stated that "DTE will review design basis ASME Class 1 component fatigue evaluations to ensure the Fermi 2 locations evaluated for the effects of the reactor coolant environment on fatigue include the most limiting components within the [RCPB]." It was unclear to the staff what methodologies are being used to identify the plant-specific limiting locations. It was also unclear what corrective actions and/or refined fatigue analysis will be used to ensure that the CUF_{en} values projected to exceed 1.0 will remain within the Code limit. By letter dated January 14, 2015, the staff issued RAI 4.3.3-1 requesting that the applicant provide the methodology being used to identify plant-specific component locations in the RCPB that are more limiting than the components identified in NUREG/CR-6260. The staff also requested that the applicant provide the corrective actions being used and/or the methodology to refine the fatigue analysis to ensure that the CUF_{en} values projected to exceed 1.0 will remain within the Code limit.

In its response dated February 12, 2015, and supplemented by letter dated March 10, 2016, the applicant stated that the methodology being used to identify plant-specific component locations in the RCPB that are more limiting than the components identified in NUREG/CR-6260 is EPRI TR 1024995, "Environmentally Assisted Fatigue Screening, Process and Technical Basis for Identifying EAF Limited Locations," dated August 2012. The response also stated that Section 3.0 of EPRI TR 1024995 provides the technical basis for the screening process and Section 4.0 provides the details of the screening process. The response further stated that the corrective actions being used to ensure that the CUF_{en} values projected to exceed 1.0 will remain within the Code limit are repair, replacement, performing refined ASME Code calculations, implementing cycle-based fatigue monitoring, and implementing stress-based fatigue monitoring.

The staff finds the applicant's response acceptable in part because the response provided the corrective actions to ensure that the CUF_{en} values projected to exceed 1.0 will remain within the Code limit. The response also revised Commitment No. 12 and Enhancement 4 of the Fatigue Monitoring Program to include cycle-based fatigue and stress-based fatigue monitoring methods. The staff's review of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8. However, EPRI TR 1024995 has not been submitted to the staff for approval and has not been endorsed by the NRC. Additionally, the application of EPRI TR 1024995 requires plant-specific review. By letter dated May 21, 2015, the staff issued RAI 4.3.3-1a requesting further information regarding the methodology being used to identify plant-specific component locations in the RCPB that are more limiting than the components identified in NUREG/CR-6260. The information requested includes (i) a description of the site-specific review that was conducted to determine that the application of the EAF screening processes being utilized is appropriate for identifying the EAF limiting locations, (ii) the evaluation of representative systems to demonstrate the adequacy of the methodology to identify the limiting plant-specific component locations, and (iii) a description of the engineering judgement, plant-specific assumptions, and plant-specific criteria used in the EAF analysis or screening process.

In its response to part (i) of RAI 4.3.3-1a, dated June 18, 2015, the applicant stated that Fermi 2 has an ASME Section III design basis for Class I vessels and piping. The response also stated that the design stress analysis and CUF values in LRA Tables 4.3-2, 4.3-4, 4.3-6, and 4.3-7 had previously been updated for 60 years of operation during a reanalysis for a power uprate. The response further stated that these activities were performed under the 10 CFR Part 50 Appendix B Quality Assurance Program, therefore making the screening process robust and comprehensive.

In its response to part (ii) of RAI 4.3.3-1a, the applicant provided the EAF evaluations of the feedwater (FW) and SLC systems as representative systems to demonstrate that the methodology conservatively identifies bounding locations. The response also states that the same degree of analytical rigor was not always applied during the screening process and that the approach being utilized takes this into account. The EAF evaluation of the FW system, provided in the response, illustrates that the same degree of analytical rigor was not always applied during the screening process. The EAF evaluation of the SLC system, provided in the response, identifies a bounding location with a CUF_{en} value that exceeds the limit of 1.0. The response states that if this location is re-evaluated to produce a CUF_{en} value below the limit of 1.0, then an additional bounding location may also be identified.

In its response to part (iii) of RAI 4.3.3-1a, the applicant provided an outline of the screening process used to identify EAF limiting locations and site-specific application of the process. The applicant stated that the F_{en} factors and associated CUF_{en} values were initially determined using strain rate, metal sulfur content, and transient temperature values that produced the most conservative results. The response also stated that when a refined analysis was performed to reduce a CUF_{en} value below 1.0, the F_{en} factor was re-evaluated to reduce its value. The response further stated that if transient pairs were subjected to only rapid cycling or solely dynamic loading that a F_{en} factor of 1.0 was used based on the guidance in Section 4.2 of NUREG/CR-6909.

The staff finds the applicant's response to part (i) of RAI 4.3.3-1a acceptable. The staff finds that the site-specific review conducted by the applicant, to determine the appropriateness of the screening processes being utilized for identifying the EAF limiting locations, is adequate for Fermi 2. The site-specific review confirmed that the applicable components have an ASME Section III Class 1 design basis. The review also confirmed that the applicable components all have CUF values that were reanalyzed for current plant conditions. The screening process was conducted under the 10 CFR Part 50 Appendix B Quality Assurance Program. The staff's concerns associated with part (i) of RAI 4.3.3-1a are resolved.

The staff finds the applicant's response to part (iii) of RAI 4.3.3-1a acceptable. In the applicant's response to part (iii), it stated that engineering judgment was used to address dynamic/rapid cycling loads. The applicant also stated that plant-specific criteria was applied to re-evaluate F_{en} factors after the initial screening. The staff confirmed that the engineering judgment and plant-specific criteria that were applied are consistent with the guidance in NUREG/CR-6909. Additional information related to engineering judgment and/or plant-specific criteria is provided in the applicant's responses to RAI 4.3.3-1b, RAI 4.3.3-2, and RAI 4.3.3-3 below. The staff's evaluation and disposition of the information in these RAIs resolves the staff's concerns associated with part (iii) of RAI 4.3.3-1a.

The staff finds the applicant's response to part (ii) of RAI 4.3.3-1a partially acceptable. The EAF evaluations provided by the applicant, to demonstrate the adequacy of the methodology to identify the limiting plant-specific component locations, included an example of an approach being utilized to conservatively identify bounding locations when the same degree of analytical rigor is not used in the evaluation. However, the overall approach being used to account for differences in analytical rigor and how it would be applied to other systems was not described. The relative ranking of analyzed locations based on CUF_{en} values may be influenced by applying different degrees of analytical rigor. Therefore, the subsequent identification of bounding locations may also be affected. The staff could not determine the adequacy of the bounding locations because it lacked sufficient information regarding the approach used to account for differences in analytical rigor. By letter dated September 1, 2015, the staff issued RAI 4.3.3-1b requesting that the applicant describe the approach used to account for differences in analytical rigor when determining bounding locations and justify that it retains an appropriate level of conservatism in the methodology being used to identify plant-specific bounding locations.

In its response dated September 24, 2015, the applicant stated that there are three circumstances in its evaluation where differences in the degree of analytical rigor may be applied and described the accompanying justification for each. These circumstances are use of design-severity instead of actual-severity plant transients, design by analysis rather than design by rule, and bundling of multiple transients using the enveloping or most severe transient.

The first instance is when actual-severity plant transients are used rather than design-severity plant transients. The applicant stated that actual-severity plant transients produce a lower CUF value compared to design-severity plant transients. The applicant stated that design-severity plant transients were used for all transients except the RWCU out of service transient. The applicant stated that the RWCU out of service transient is not part of the Fermi 2 design basis but is known to contribute to fatigue usage in the RWCU system and connected systems. Fermi 2 concluded that including this actual-severity plant transient is conservative given that it is not part of the design basis for Fermi 2.

The second instance is when the more rigorous design by analysis (ASME Section III, NB-3200) method is used to calculate fatigue usage compared to the design by rule (ASME Section III, NB-3600) method. The applicant stated that the CUF values determined using the design by analysis method were often larger than those determined using the design by rule method for a given system or subsystem. The applicant also stated that when a CUF value was calculated using the design by analysis method, the design by rule calculations were also performed so that CUF values determined using different methods could be compared on a common basis.

The third instance is where multiple transients were bundled rather than using each load set transient pair. The applicant stated that bundling transients reduces the computational time required to perform a fatigue analysis; is used when the fatigue margin is sufficiently large; and results in an inflated CUF value. The applicant also stated that engineering judgment was applied to ensure that locations with higher CUF_{en} values due to the bundling of transients are not inappropriately identified as bounding locations for a system or subsystem. The applicant further stated that this was done by identifying locations where bundled transients were applied and assessing the severity of the individual transients relative to locations with lower CUF values that did not bundle transients. Additionally, the applicant states that this process was used consistently through the evaluation.

The staff finds the applicant’s response acceptable because the differences in analytical rigor used by the applicant when determining bounding locations were either more representative of actual plant operations or conservative. The applicant used design-severity plant transients, versus actual-severity plant transients, for all but one transient. An actual-severity plant transient was used for the RWCU out of service transient. The RWCU out of service transient is not part of the Fermi 2 design basis. The staff agrees with the applicant’s conclusion that the addition of this transient is conservative because it was applied consistently to the applicable systems and appropriately increases fatigue usage for those systems. The applicant also used the more rigorous design by analysis method to calculate fatigue usage for some locations. When the largest CUF value within a system is not a value determined using the design by analysis method, calculations are performed using both methods so that CUF values can be compared on a common basis. Determining the CUF values using both design methods ensures that the most limiting location is identified. The bundling of transients increases fatigue usage and the applicant used engineering judgment to ensure that the most limiting location within a system was properly identified. This application of engineering judgment is only necessary when a location using bundled transients is found to be limiting for a system or subsystem. When this occurs the applicant compares the severity of the bundled transients to those of the other locations within the system to verify that the most limiting location is selected as bounding. The evaluation of the feedwater system, provided in the applicant's response to part (ii) of RAI 4.3.3-1a, demonstrates how the applicant applied engineering judgment when bundling transients. The staff's concerns described in RAIs 4.3.3-1, 4.3.3-1a, and 4.3.3-1b are resolved.

By letter dated June 26, 2015, the applicant submitted the annual update for LRA Section 4.3.3 which includes a summary of the steps involved in the EAF screening process. The process used to screen locations, identify bounding locations, and reduce bounding locations has also been partially summarized in the response to RAI 4.3.3-1 and follow-up RAIs 4.3.3-1a and 4.3.3-1b. However, none of these documents fully describe the process. Additionally, when reviewed as a group, the documents still leave areas of uncertainty and potentially inconsistent steps/activities. The process is not defined clearly enough to be evaluated by the staff. By letter dated September 1, 2015, the staff issued RAI 4.3.3-2 requesting that the applicant describe the steps of the screening process in sufficient detail to be performed independently on a random system. The staff also requested that the applicant describe and justify any engineering judgment, all plant-specific assumptions, and all plant-specific criteria for each step in the process.

In its response dated September 24, 2015, the applicant stated that the only engineering judgment applied in the process was related to differences in degree of analytical rigor and the only plant-specific assumptions/criteria were related to the DO content associated with each water chemistry zone. The response also provided additional information on the steps involved in the EAF screening process. The following steps are derived from the information provided by the applicant in its LRA annual update (dated June 26, 2015) and from the applicant's responses to RAI 4.3.3-1a (dated June 18, 2015) and RAI 4.3.3-1b (dated September 24, 2015):

(1) Prescreening: All ASME Class 1 RPV and piping locations with CUF values were reviewed to determine if an EAF evaluation was necessary. Locations that are not exposed to reactor water or part of the RCPB were eliminated. All the remaining RCPB locations with CUF calculations comprise the population to be evaluated for the effects of EAF.

(2) Determination of Candidate Locations: Each location in the population was examined and the locations with the largest CUF values were identified for each system or subsystem. Each material type within a system or subsystem was retained for additional evaluation because the application of the F_{en} factor to a CUF value may affect the relative ranking of CUF_{en} values for these locations. All remaining locations were eliminated. The candidate population consists of the locations with the largest CUF values and a location representing each material type for a given system or subsystem.

(3) Determination of Bounding Locations: The CUF value for each candidate location was revised using the applicable fatigue curve provided in NUREG/CR-6909. Time-weighted F_{en} factors were determined using the plant-specific water chemistry history to establish DO content and the least favorable values for sulfur content of the material, strain rate, and temperature as inputs to the applicable formulas in NUREG/CR-6909. CUF_{en} values were determined for each candidate location by multiplying the revised CUF value by the accompanying F_{en} factor. The CUF_{en} values for each location are tabulated by system or subsystem.

(4) Finalize Bounding Locations: All NUREG-6260 locations are established as bounding locations. The location with the largest CUF_{en} value in each system or subsystem for each material type is selected. All locations with CUF_{en} values of less than 0.8 are subsequently eliminated unless the location is part of a component with other material types that exceed 0.8 for other locations. The locations with the second highest CUF_{en} value for each material type is retained if it is within 50 percent of the largest location for a given system or subsystem. Any locations that do not meet these criteria are eliminated. The remaining locations are the final bounding locations for EAF (sentinel locations).

The staff finds the applicant's response acceptable because, when combined with the LRA annual update and the response to RAI 4.3.3-1a, the process used to identify leading locations that bound the effects of EAF has been described and is appropriately conservative. The prescreening process (Step 1) ensures that all locations potentially effected by EAF are identified for evaluation. Establishing a candidate population (Step 2) ensures that each material type and the locations with the highest fatigue usage are evaluated for each system or subsystem. The preliminary bounding locations (Step 3) were determined by establishing F_{en} factors and CUF_{en} values for the candidate locations in accordance with staff approved guidance. Finalizing the bounding locations (Step 4) reduces the population of bounding locations to a subset of limiting locations to be managed by the Fatigue Monitoring Program. This subset of locations is appropriate for bounding the effects of EAF because the CUF_{en} threshold value 0.8 is more conservative than the Code limit of 1.0. The inclusion of a second bounding location, if it is within 50 percent of the leading location for a given system or subsystem, provides additional assurance that the most limiting locations are monitored. Including any location of a different material type if it is part of a component that contains a location that is greater than or equal to 0.8 is conservative because it ensures that locations with different material types are tracked regardless of their CUF_{en} value. Additionally, all NUREG-6260 locations are also established as bounding locations. The staff also noted that the bounding locations for carbon steel, low alloy steel, stainless steel, and nickel based alloy have CUF_{en} values as low as 0.045, 0.095, 0.071, and 0.273, respectively. These CUF_{en} values are significantly lower than the Code limit of 1.0. The staff reviewed the application of engineering judgment in the process in its disposition of RAIs 4.3.3-1a and 4.3.3-1b. The staff's concern described in RAI 4.3.3-2 is resolved.

LRA Table 4.3-8, as revised by the LRA annual updates dated June 26, 2015, contains bounding locations with CUF_{en} values projected to exceed 1.0. This update reduced by four the number of locations that were identified in the LRA as having CUF_{en} values projected to exceed 1.0. Of these four locations, two were re-evaluated and the CUF_{en} values were reduced to less than 1.0, one was eliminated because it is not a pressure boundary location, and one was eliminated because it is bounded by adjacent piping. This update also identified two new locations with CUF_{en} values greater than 1.0, the stainless steel condensing chamber and the nickel-based alloy core ΔP nozzle location. The remaining four locations with CUF_{en} values greater than 1.0 (e.g., the two cited above and nickel-based alloy CRD nozzle and the stainless steel portion of the FW nozzle safe end identified in the LRA) will be managed by the Fatigue Monitoring Program and further actions will be taken in accordance with the AMP. Further actions may include refining the fatigue analyses to produce CUF_{en} values below 1.0. It was unclear to the staff how bounding locations with CUF_{en} values projected to exceed 1.0 will be affected if the fatigue analyses are refined to reduce the CUF_{en} value. By letter dated September 1, 2015, the staff issued RAI 4.3.3-3 requesting that the applicant describe the process used to rank locations that have been (or will be) re-evaluated because the CUF_{en} value exceeds the limit of 1.0. The staff also requested that the applicant justify that the process retains an appropriate level of conservatism to identify plant-specific bounding locations.

In its response dated September 24, 2015, the applicant stated that the F_{en} factors were recalculated for locations where the CUF_{en} value was projected to exceed 1.0. The applicant stated that the recalculations reduced the F_{en} factors by applying average transient temperatures or maximum operating temperatures rather than the design temperature. The applicant also stated that recalculating the F_{en} factors reduced the CUF_{en} values for two locations (SLC piping inside containment and core spray penetration X-16A/B body) to below the screening threshold 0.8, although four locations still exceeded the limit of 1.0. The four locations are the CRD nozzles, feedwater nozzles, condensing chambers, and core ΔP nozzle. These four locations projected to exceed 1.0 will be reanalyzed in accordance with the Fatigue Monitoring Program. The applicant further stated that three locations, which are the CRD nozzles, feedwater nozzles, and core ΔP nozzle, will be retained as bounding locations after reanalysis unless the current values are determined to be a result of significant over-conservatisms in the current analysis that would have resulted in these values not being selected initially if they had been analyzed in a manner consistent with the other component locations. Additionally, the applicant provided the intended re-evaluation approach for each of the locations.

The staff finds the applicant’s response partially acceptable because re-evaluated locations will be ranked in a manner consistent with the criteria described in Step 4 of the EAF screening process. Additionally, using the average transient temperatures to calculate the F_{en} factors is also consistent with NUREG/CR-6909, provided that the specific guidance for determining the average temperature is followed. The staff noted that the method used to calculate the average temperature, per NUREG/CR-6909, depends on whether the minimum transient temperature exceeds the threshold temperature for the material, which is the temperature below which environmental effects are considered insignificant. When the minimum transient 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 transient temperature. When the minimum transient temperature is below the threshold temperature, the transient maximum temperature and the threshold temperature are used to calculate the average temperature. The staff also noted that NUREG/CR-6909 states that the average temperature may be used to calculate the F_{en} factor only when the transient has a constant strain rate and a linear temperature response.

Therefore, on December 15, 2015, the staff held a conference call with the applicant to obtain clarification on the applicant’s response to RAI 4.3.3-3 and the manner in which the average temperatures were calculated by the applicant to confirm that the method is consistent with NUREG/CR-6909. During the conference call, the applicant described the methods used to calculate the average temperatures. The applicant stated that in one of the methods, the minimum transient temperature was used instead of the threshold temperature to calculate the average temperature. If the resulting temperature was less than the threshold temperature, the threshold temperature was used to calculate the F_{en} factor. Based on these descriptions, the staff determined that the applicant had calculated average temperatures using minimum temperature values that, in some cases, were below the threshold value, which is not consistent with the guidance in NUREG/CR-6909. The staff had concerns that this may result in the underestimation of both the F_{en} factors and the resulting CUF_{en} values for some locations. By letter dated January 14, 2016, the staff issued followup RAI 4.3.3-3a requesting that the applicant assess the impact of revising the evaluations to use the correct determination of average temperature in a manner consistent with NUREG/CR-6909 and submit a description of the impact of this revision to the previous screening and F_{en} evaluation results for staff review. The followup RAI also requested that the applicant's assessment include a description of whether the revised average temperature calculations impacts the selection of sentinel locations. In its response dated January 22, 2016, the applicant identified six locations where average transient temperatures were used to calculate F_{en} factors. The F_{en} factors for five of the six locations were recalculated to become consistent with the guidance in NUREG/CR-6909. The remaining location (core ΔP nozzle) was consistent with the guidance in NUREG/CR-6909. The core ΔP nozzle was re-evaluated for the purpose of refining the analysis. The following information describes the applicant's re-evaluation of these six locations:

- The F_{en} factor for the core ΔP nozzle location was originally determined using bundled transients and the average temperature of the dominant transient was calculated in a manner consistent with the guidance in NUREG/CR-6909. The re-evaluation of this location unbundled the transients and used the maximum design temperature for the location. The CUF_{en} value for this location was reduced from 1.48 to 0.929. This location remains a bounding location in accordance with the screening criteria.
- The F_{en} factor for the SLC piping inside containment was originally determined using an average temperature for the startup and shutdown load set values that used a minimum transient temperature that was below the stainless steel threshold temperature. This method of calculating average temperature is not consistent with the guidance in NUREG/CR-6909. The re-evaluation of this location uses a minimum transient temperature equal to the stainless steel threshold temperature to calculate the average temperature in accordance with NUREG/CR-6909. All transients associated with the fatigue usage of this location have a constant strain rate and linear temperature response that, therefore, make them simple transients, consistent with NUREG/CR-6909. The CUF_{en} value for this location increased from 0.503 to 0.658. Although DTE previously stated that this was not a sentinel location, as noted in the annual update dated May 9, 2016, DTE decided to conservatively identify the SLC piping inside containment as a sentinel location and revised LRA Table 4.3-8 to reflect this.
- The F_{en} factor for the CRD nozzle location was originally determined using bundled transients and average temperatures that used minimum transient temperatures that were below the nickel-based alloy threshold temperature. This method of calculating average temperature is not consistent with the guidance in NUREG/CR-6909. The re-evaluation of this location unbundled the transients and used the maximum design temperature for the location. The CUF_{en} value for this location was reduced from 1.28 to 0.191. This location remains a bounding location in accordance with the screening criteria.
- The F_{en} factor for the CRD assembly main flange location was originally determined using average temperatures that used minimum transient temperatures below the stainless steel threshold temperature. This method of calculating average temperature

is not consistent with the guidance in NUREG/CR-6909. The re-evaluation of this location uses a maximum service temperature for all of the transients except the startup transient that uses an average temperature determined using a minimum transient temperature equal to the stainless steel threshold temperature in accordance with NUREG/CR-6909. The startup transient is a simple transient because it has a constant strain rate and linear temperature response. The CUF_{en} value for this location increased from 0.329 to 0.725. This location is still not a bounding location in accordance with the screening criteria.

- The F_{en} factor for the reactor recirculation pump cooler location was originally determined using an average temperature for the on-off-on transient that used the stainless steel threshold temperature as the minimum temperature. The on-off-on transient is not a simple transient; therefore, calculating an average temperature for this transient is not consistent with the guidance in NUREG/CR-6909. The re-evaluation of this location uses the design temperature of 575 °F and appropriately accounted for the cooler being replaced in 1998. The CUF_{en} value for this location was reduced from 0.581 to 0.578. This location remains a bounding location in accordance with the screening criteria.
- The feedwater nozzles have carbon steel, low alloy steel, and stainless steel locations subjected to EAF evaluation. The F_{en} factors for carbon steel and low alloy steel locations were determined using the maximum design temperature. The F_{en} factor for the stainless steel location was originally determined using average transient temperatures. However, not all of the transients associated with the stainless steel location are simple transients; therefore, calculating an average temperature for this location is not consistent with the guidance in NUREG/CR-6909. The re-evaluation of the stainless steel location uses the maximum design temperature of 575 °F. Additionally, all three locations (carbon steel, low alloy steel, and stainless steel locations) of the feedwater nozzles were re-evaluated to treat the hot standby transient and reactor core isolation cooling system injection as unique transients. The CUF_{en} values for the carbon steel, low alloy steel, and stainless steel locations were reduced from 0.165, 0.115, and 6.37 to 0.083, 0.113, and 5.55, respectively. These three locations remain bounding locations in accordance with the screening criteria.

The applicant's response revised LRA Table 4.3-8 to reflect the results of the re-evaluation for the six locations described above and to make unrelated editorial changes. The applicant's response also provided the material of construction and a description of the temperature used to calculate the F_{en} factors for all the locations in LRA Table 4.3-8 that did not use average transient temperature. Additionally, the applicant clarified that the core spray penetration X-16A/B carbon steel body used the maximum operating temperature in its EAF calculations.

The staff finds the applicant's response acceptable because the applicant identified all of the locations that used an average temperature to calculate the F_{en} factors and re-evaluated them to either (a) use the design temperature or maximum operating temperature instead of an average temperate or (b) use an average temperature determined in a manner consistent with NUREG/CR-6909. The SLC piping inside containment and CRD assembly main flange are the only locations that use average transient temperatures to calculate F_{en} factors. The staff verified that a minimum transient temperature equal to the stainless steel threshold temperature was used to calculate the average temperature value; the transients associated with the average temperature value have a constant strain rate and linear temperature response; and the calculations for these locations are consistent with the guidance in NUREG/CR-6909. The staff also verified that the screening criteria were consistently applied after these six locations were re-evaluated and that the sentinel locations did not change.

In its annual update dated May 9, 2016, the applicant stated that it performed a revised CUF_{en} calculation for the condensing chamber using a new stress and fatigue analysis. The applicant stated that the new CUF_{en} value is 0.025. The applicant stated that this location now has a lower CUF_{en} value than a NUREG/CR-6260 feedwater nozzle-vessel intersection of the RPV upper region. However, the staff noted that the feedwater nozzle-vessel intersection is a low alloy steel component, and the condensing chamber is a stainless steel component. The staff further noted that the applicant is monitoring a stainless steel component in the RPV upper region, the feedwater nozzle safe end. Since the condensing chamber has a lower CUF_{en} value than the feedwater nozzle safe end, the condensing chamber is bounded by a NUREG/CR-6260 location and is no longer a more limiting plant-specific location. Based on its response to RAI 4.3.3-3 and its annual update by letter dated May 9, 2016, the applicant further stated that three locations, which are the CRD nozzles, feedwater nozzles, and core ΔP nozzle, will be retained as bounding locations after reanalysis unless the current values are determined to be a result of significant over-conservatisms in the current analysis that would have resulted in these values not being selected initially if they had been analyzed in a manner consistent with the other component locations. In addition, the 2016 update revised LRA Table 4.3-8 to reflect the results of the re-evaluation for the locations described above.

The staff noted that the CUF_{en} value for one location is still projected to exceed 1.0, as described in a letter dated May 9, 2016. The location is the stainless steel portion of the reactor vessel feedwater nozzle safe end. The applicant will manage this location using the Fatigue Monitoring Program to ensure that the CUF_{en} limit is not exceeded. The applicant stated that it intends to reanalyze and/or use stress-based fatigue monitoring for this location in accordance with the Fatigue Monitoring Program. The staff's concerns described in RAI 4.3.3-3 and RAI 4.3.3-3a are resolved.

The May 9, 2016, update letter also modified the list of sentinel locations. The final list of locations is based on a combination of the January 22, 2016, update letter and the May 9, 2016, update letter.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of environmentally assisted fatigue due to the reactor water environment on the intended functions of the ASME Class 1 reactor pressure vessel boundary will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.3 because the applicant has addressed the staff recommendation for the closure of GSI-190. The applicant has identified high fatigue usage locations, including those in NUREG/CR-6260, and has evaluated these locations using the formulas, fatigue curves, and guidance in NUREG/CR-6909. The applicant is managing the effects of cumulative fatigue damage on the intended functions of the applicable components using the Fatigue Monitoring Program. The staff's review of the Fatigue Monitoring Program appears in SER Section 3.0.3.2.8.

4.3.3.3 UFSAR Supplement

LRA Section A.2.2.3, as revised by the LRA annual update dated June 26, 2015, provides the UFSAR supplement summarizing the evaluation for the effects of reactor water environment on fatigue life. The staff reviewed LRA Section A.2.2.3 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the review verifies that the applicant has provided a summary description of the TLAA to be included in the UFSAR supplement. The SRP-LR also states that the review verifies that the information provided in the UFSAR supplement is equivalent to that in SRP-LR Table 4.3-2.

The staff also noted that the applicant committed to developing EAF usage calculations that consider the effects of the reactor water environment (Commitment No. 12b) and to revising the Fatigue Monitoring Program procedures to maintain the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects (Commitment No. 12d). This commitment is to be implemented before entering the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the effects of reactor water environment on fatigue life, 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 provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of environmentally assisted fatigue due to the reactor water environment on the intended functions of pressure boundary components will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the evaluation, as required by 10 CFR 54.21.

4.4 Environmental Qualification (EQ) Analyses of Electric Equipment

The EQ program in 10 CFR 50.49, “Environmental Qualification (EQ) of Electric Equipment Important to Safety for Nuclear Power Plants,” is a TLAA for the purposes of license renewal. The TLAA of the EQ electrical components includes all long-lived, passive, and active electrical and instrumentation and control (I&C) components that are important to safety and located in a harsh environment. The harsh environments of the plant are those areas subject to environmental effects by LOCAs or high-energy line breaks (HELBs). EQ equipment comprises safety-related, Q-list, and nonsafety-related equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary post-accident monitoring equipment.

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4 describes the applicant’s TLAAs for the EQ analyses of electric equipment. The applicant stated that qualification is established for the environmental and service conditions expected for normal plant operation and those conditions postulated for plant accidents. The applicant also stated that equipment qualification evaluations for EQ components that result in a qualification of at least 40 years, but less than 60 years, are considered TLAAs for license renewal. The LRA states that the “Environmental Qualification (EQ) of Electric Components” Program (EQ Program) is an existing program established to meet Fermi 2 commitments for 10 CFR 50.49. The LRA also states that through the applicant’s EQ Program, as required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended before reaching the aging limits established in the evaluation. The LRA further states that the reanalysis of an aging evaluation addresses attributes of the analytical methods, data reduction and collection methods, underlying assumptions, acceptance criteria, and corrective actions.

The applicant dispositioned the TLAAs for the EQ analyses of electric equipment in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of aging on the intended functions will be adequately managed by the EQ Program for the period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed the applicant's TLAAs for the EQ analyses of electric equipment and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.4.3.1.3, which state that the reviewer verifies that the applicant has identified the appropriate program as described in the GALL Report. The acceptance criteria in SRP-LR Section 4.4.2.1 states 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 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 4, and 10 CFR 50.49 specifically require each applicant to establish a program to qualify electrical equipment so that such equipment, in its end-of-life condition, will meet its performance specifications during and following design-basis accidents. An EQ Program per the requirements of 10 CFR 50.49 is considered an 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 are considered a TLAA for licensee renewal. The EQ of electric components 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 LOCA, a HELB, or post-LOCA environment. EQ equipment comprises safety-related and nonsafety-related equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary operation of post-accident monitoring equipment.

The staff reviewed LRA Sections 4.4 and B.1.15 (EQ Program), plant basis documents, 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 EQ analyses of electric equipment TLAA evaluation to demonstrate that EQ equipment aging mechanisms and effects will be adequately managed during the period of extended operation. The GALL Report states that plant EQ programs that implement the requirements of 10 CFR 50.49 are considered acceptable AMPs to meet the requirements of 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 EQ 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 EQ Program manages the aging effects of components associated with the EQ analyses of electric equipment TLAA in order to meet the requirements pursuant to 10 CFR 50.49. The staff conducted an audit of the information provided in LRA Sections 4.4, A.2.3, B.1.15, and A.1.15 and program-basis documents, including the AMR of electrical systems, AMP evaluation results, and operating experience reviews – AMP effectiveness. LRA Section B.1.15 discusses the component reanalysis attributes, including analytical models, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions. On the basis of its audit and review of LRA Section B.1.15, the staff concludes that the EQ Program the applicant claimed to be consistent with GALL Report AMP X.E1 is consistent; therefore, the staff also concludes that the applicant's EQ analyses of electric equipment TLAAs are implemented in accordance with the requirements of 10 CFR 54.21(c)(1)(iii). The staff's review of the applicant's EQ Program is documented in SER Section 3.0.3.1.9.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii) that the effects of aging on the intended functions of components within the scope of the EQ Program will be adequately managed by the EQ Program for the period of extended operation. Additionally, the EQ analyses of electric equipment meets the acceptance criteria in SRP-LR Section 4.4.2.1.3 because the applicant's EQ Program is consistent with GALL Report AMP X.E1, and therefore is capable of programmatically managing the qualified life of components within the scope of the program for license renewal. The staff finds that the continued implementation of the EQ Program provides reasonable 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, per the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1)(iii).

4.4.3 UFSAR Supplement

LRA Section A.2.3 provides the UFSAR supplement summarizing the EQ analyses of electric equipment TLAAs. The staff reviewed LRA Section A.2.3 consistent with the review procedures in SRP-LR Section 4.4.3.2, which state that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the TLAA evaluation of the EQ of electric equipment and the applicant has provided a UFSAR supplement with information equivalent to that in Table 4.4-2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.4.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the EQ analyses of electric equipment TLAAs for the period of extended operation, 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 aging mechanisms and effects of thermal, radiation, and cyclical aging on the intended functions of the electric equipment will be adequately managed by the EQ Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAAs evaluation, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress Analyses

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 describes the applicant's TLAA for containment tendon prestress analyses. LRA Section 4.5 and Table 4.1-1 state that this TLAA is not applicable because the Fermi 2 containment design does not include tendons.

4.5.2 Staff Evaluation

The staff reviewed UFSAR Section 3.8.2 and confirmed that the Fermi 2 containment structure is a Mark I steel containment and, therefore, its design does not include prestress tendons. The staff evaluated the applicant's claim that concrete containment tendon prestress analysis is not a TLAA for the Fermi 2 steel containment, and finds it acceptable because such prestressing tendons are used only in prestressed concrete containment structures.

4.5.3 UFSAR Supplement

The staff concludes that an UFSAR supplement is not required because this TLAA is not applicable to containments without prestress tendons.

4.5.4 Conclusion

On the basis of its review, the staff concludes that this TLAA is not applicable to Fermi 2 and an UFSAR supplement is not required.

4.6 Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analyses

LRA Section 4.6 provides the applicant's TLAAs for fatigue analyses of the following containment structural components.

- primary containment
- vent line bellows
- refueling and drywell seal bellows
- traversing incore probe (TIP) penetration bellows
- containment penetrations

4.6.1 Primary Containment

4.6.1.1 Summary of Technical Information in the Application

LRA Section 4.6.1, as revised by the LRA annual update dated June 26, 2015, describes the applicant's TLAA for the Fermi 2 Mark I steel containment suppression chamber (torus) and vent system whose design comply with the requirements for Class B vessel in ASME Code Section III. The applicant stated that the suppression chamber shell, supports, internals, and attachments have also been re-evaluated to include the hydrodynamic loading events and analysis methods defined by GE Topical Report NEDO-21888, "Mark I Containment Program Load Definition Report," dated December 1978, and NUREG-0661, "Safety Evaluation Report: Mark I Containment Long-Term Program," dated July 1980 (ADAMS Accession No. ML11203A031). The applicant also stated that appropriate service limits and the edition of the ASME Code Section III, specified in NUREG-0661, were applied to the reanalysis, which is documented in the plant unique analysis report for Fermi 2. LRA Table 4.6-1 summarizes the calculated bounding CUFs of the suppression chamber as 0.486 for the torus shell and 0.238 for welds. LRA Table 4.6-1 also summarizes the CUFs of the containment vent system as 0.550 for the vent header and 0.194 for welds. The applicant further stated that transient cycles from safety relief valve (SRV) actuations and seismic cycles are tracked by the Fatigue Monitoring Program described in LRA Section B.1.17 and will be maintained below the cycle value used in the fatigue evaluation, or a reanalysis will be completed prior to exceeding the design limits considered in the fatigue evaluations.

The applicant dispositioned the TLAAs for the containment suppression chamber (torus shell, welds) and the containment vent system (vent header, welds) in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of aging due to fatigue on the intended functions will be adequately managed by the Fatigue Monitoring Program for the period of extended operation.

4.6.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the fatigue design of the Fermi 2 Mark I steel containment suppression chamber (torus) and vent system and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.3, which state that the applicant's proposed AMP is reviewed to ensure that the effects of aging on the component's intended functions are adequately managed for the period of extended operation.

The staff noted that LRA Table 4.6-1 documented CUF values from SRV actuation, seismic or other applicable transient events, for the containment suppression chamber and the vent system, which are less than the code allowable limit of 1.0. During its review of components associated with LRA Table 3.5.1, item 3.5.1-9, the staff noted that LRA Table 3.5.2-1 includes, on LRA page 3.5-64, an AMR item for component type "steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region" which credits TLAA - metal fatigue as the AMP. The staff noted that LRA Table 3.5.2-1 also includes, on LRA page 3.5-65, an AMR item for component type "steel elements: torus; vent line; vent header; vent line bellows; downcomers." These AMR items in LRA Table 3.5.2-1 correspond to item 3.5.1-9 in LRA Table 3.5.1, which refers to the further evaluation in LRA Section 3.5.2.2.1.5. LRA Section 3.5.2.2.1.5, "Cumulative Fatigue Damage," states, in part, that "the evaluation of fatigue as a TLAA for the Fermi 2 containment, including its drywell shell, torus, vent line bellows, downcomers, etc., is addressed in [LRA] Section 4.6." However, from its review of LRA Section 4.6.1 "Primary Containment," the staff could not find fatigue analyses or fatigue waiver analyses of the Fermi 2 primary containment drywell and the downcomers, specified by the ASME Code Section III (code of record), as a TLAA that was credited to manage fatigue cracking in the above mentioned items in LRA Table 3.5.2-1 and LRA Table 3.5.1. By letter dated January 14, 2015, the staff issued RAI 4.6.1-1 requesting the applicant to state whether or not the fatigue analysis or fatigue waiver analysis of the drywell and the downcomers required by ASME Code Section III is a TLAA under the CLB and, if so, to provide an evaluation of the fatigue analysis for these components in accordance with10 CFR 54.21(c)(1) to justify crediting it in the AMR results items mentioned above. The staff also requested the applicant to update the LRA, as appropriate, to be consistent with the responses to the above requests.

In its response dated February 12, 2015, the applicant stated that stress analyses for the drywell shell and drywell head are not TLAAs since no cyclic loads were identified for these components in the applicable design specification in the CLB. The applicant also clarified that the downcomers are included as part of the vent system fatigue analysis identified as a TLAA in LRA Section 4.6.1, for which the bounding CUF results are documented in LRA Table 4.6-1. The applicant revised LRA Table 3.5.2-1 to delete the AMR item, corresponding to item 3.5.1-9 on LRA page 3.5-64, for component type "steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region" that credits AMP "TLAA - metal fatigue" to manage the “cracking” aging effect. The applicant also revised LRA Section 3.5.2.2.1.5, “Cumulative Fatigue Damage,” to delete the reference to the TLAA for the drywell shell.

The staff finds the response to RAI 4.6.1-1 acceptable because the applicant clarified that (a) the fatigue evaluation of the drywell shell and head is not a TLAA in the CLB and (b) the fatigue evaluation of the downcomers are included and bounded as part of the vent system fatigue analysis results in LRA Section 4.6.1. The staff also finds the revision to LRA Table 3.5.2-1 and LRA Section 3.5.2.2.1.5 to delete the AMR item and reference to the drywell shell components acceptable because no CLB fatigue analysis exists for the component type. The staff’s concern described in RAI 4.6.1-1 is resolved.

The staff noted that the TLAA evaluations for primary containment components in LRA Section 4.6.1 and containment penetrations in LRA Section 4.6.5 appear to include load cycles from seismic operating-basis earthquake (OBE) and possibly safe-shutdown earthquake (SSE) events that the applicant claimed to track using the Fatigue Monitoring Program described in LRA Section B.1.17. However, the program descriptions in LRA Section B.1.17, “Fatigue Monitoring,” LRA Section A.1.17 “Fatigue Monitoring,” and GALL Report AMP X.M1, “Fatigue Monitoring,” appear focused on monitoring and tracking critical thermal and pressure transients for selected components. It was not clear to the staff whether the Fatigue Monitoring Program, credited in the disposition of the TLAAs in LRA Sections 4.6.1 and 4.6.5 in accordance with 10 CFR 54.21(c)(1)(iii), included under its scope load cycles from OBE and SSE events as parameters monitored and tracked. Further, it was not clear as to the number of specific load cycles considered in the fatigue evaluation for each OBE event and/or SSE event that defines the total bounding limit of seismic load cycles monitored against by the credited Fatigue Monitoring Program. By letter dated January 14, 2015, the staff issued RAI 4.6.1-2 requesting the applicant to (1) clarify whether the Fatigue Monitoring Program includes under its scope load cycles from OBE or SSE (as applicable) events as parameters monitored and tracked, and (2) state the number of specific load cycles considered in the fatigue evaluations in LRA Sections 4.6.1 and 4.6.5 for each OBE or SSE event, as applicable, and clarify why seismic SSE is not listed as an analyzed transient in LRA Table 4.3-1.

In its response dated February 12, 2015, to Part 1 of RAI 4.6.1-2, the applicant stated that the “Fatigue Monitoring Program includes all normal, upset, and testing condition events that are included in the TLAAs discussed in LRA Sections 4.6.1 and 4.6.5.” The applicant explained that OBE is an upset condition event that is included in the fatigue analysis, as required by ASME Code Section III, and counted in the Fatigue Monitoring Program. The applicant also stated that the “number of cycles experienced by each component per OBE event (two OBE events are considered as indicated in LRA Table 4.3-1) varies from 5 to 250 cycles, as described in UFSAR Section 3.7.3.1,” and that the total number of cycles considered in the analysis of some components may be greater.

In its response to Part 2 of RAI 4.6.1-2, the applicant stated that the fatigue analyses in LRA Section 4.6.1 considered 600 seismic OBE cycles for the suppression chamber (torus shell) and 1,000 cycles for the containment vent system. The applicant also stated that for the fatigue analysis of flued head penetrations addressed in LRA Section 4.6.5, 530 OBE cycles were considered for penetrations X-9A/B, 90 OBE cycles for penetration X-10, and 508 OBE cycles for the remaining penetrations. The applicant further explained that, as stated in UFSAR Section 3.7.3.1, “SSE is an emergency condition event that requires plant shutdown in accordance with the [TS],” and emergency or faulted condition events are not required to be considered in fatigue evaluations by ASME Code Section III. With regard to emergency events, fatigue considerations would need to be addressed as part of the activities required for plant restart.

The staff reviewed UFSAR Section 3.7.3.1 and confirmed that OBE is an upset condition required to be included in the fatigue evaluation and that SSE is an emergency condition not required to be included in the fatigue evaluation in the CLB in accordance with ASME Code Section III. The staff also noted the number of OBE seismic cycles considered by the applicant is conservative because there are more than the 20 cycles per seismic event indicated in UFSAR Section 3.7.3.1 for conservative design. The staff finds the response to RAI 4.6.1-2 acceptable because the applicant (a) clarified that seismic OBE cycles are included and counted by the Fatigue Monitoring Program, (b) clarified that SSE, being an extreme or faulted event, is not required to be included in the fatigue evaluation by ASME Code Section III, and therefore not included as a plant transient in LRA Table 4.3-1, and (c) provided the actual number of seismic OBE cycles considered in the fatigue analysis of the different components addressed in LRA Sections 4.6.1 and 4.6.5, which are conservative. The staff's concerns described in RAI 4.6.1-2 are resolved.

Additionally, the staff noted that LRA Section 4.6.1 states that "SRV actuations and seismic cycles are tracked [by the Fatigue Monitoring Program] and will be maintained below the cycle value used in the fatigue evaluation, or re-analysis will be completed." However, it was not clear which specific transient events (other than seismic) and corresponding analysis (cycle) input values were used in calculating the CUFs documented in LRA Table 4.6-1 for the containment suppression chamber and containment vent system, and will be monitored by the Fatigue Monitoring Program. By letter dated January 14, 2015, the staff issued RAI 4.6.1-3 requesting the applicant to state the specific applicable transients and corresponding cycle input limits that were used in the fatigue analyses for calculating the CUF values documented in LRA Table 4.6-1 for the containment suppression chamber (torus) and the containment vent system and will be monitored by the Fatigue Monitoring Program, and to clarify if the applicable transients were listed in LRA Table 4.3-1.

In its response dated February 12, 2015, to RAI 4.6.1-3, the applicant stated that the CUFs shown in LRA Table 4.6-1 for the torus shell and vent are for the controlling case, which is normal operating conditions plus the (one) small break accident (SBA) event. The applicant stated that the governing transient, under normal operating conditions, are the SRV discharge loads from individual and/or multiple SRV actuations. For the containment vent system, the applicant explained that the largest CUF value was in the vent header at the intersection of downcomer and the header, with the magnitudes and numbers of cycles of downcomer lateral loads being the primary contributors to fatigue at this location. The applicant further explained that for the vent system weld, the largest CUF value was at the nozzle to gusset weld at the SRV penetration to the vent line, with the SRV temperature and thrust loads and the number of SRV actuations being the major contributors to fatigue at this location. The applicant stated that "[c]ycles from LRA Table 4.3-1 considered in these analyses for containment vent include individual SRV actuation [1435 cycles from LRA Table 4.3-1] and 1000 seismic [OBE] cycles." The applicant further stated that the "governing load combination also includes SBA condensation oscillation and chugging load cycles." For the suppression chamber (torus shell), the applicant stated that cycles from LRA Table 4.3-1 considered in the fatigue analyses include SRV discharge loads from individual (largest contributor) and multiple SRV actuations, and 600 seismic (OBE) cycles. The applicant explained that the governing load combination also include SBA chugging load cycles. The applicant further stated that SRV actuations (single and multiple) and OBE events are included in LRA Table 4.3-1, and clarified that drywell pipe break events (e.g., SBA), which are faulted events, are not included in LRA Table 4.3-1 because

"ASME Code Section III does not require fatigue evaluation of emergency and faulted condition events." The applicant explained that if an emergency or faulted condition event occurs during plant operation, it must be evaluated as part of plant restart activities.

The staff noted from the response that the controlling transient contributors in the fatigue analyses of the Fermi 2 suppression chamber (torus) and the containment vent system are the SRV actuations during normal operating conditions, and seismic OBE events (upset condition). The staff also noted that cycles from both these transient events are included in LRA Table 4.3-1, and are tracked by the Fatigue Monitoring Program. The staff reviewed UFSAR Section 3.6.1.5.1 and confirmed that pipe break events are considered faulted events, which are not required to be included in fatigue evaluations by ASME Code Section III. Therefore, although load cycles from a single SBA event are conservatively accounted for in the fatigue usage evaluations, it is not necessary to monitor these cycles through the Fatigue Monitoring Program, and if a faulted event occurs during plant operation, its effects including fatigue considerations are evaluated prior to return to service. The staff finds the response to RAI 4.6.1-3 acceptable because the applicant (1) identified the applicable transients (i.e., SRV actuations, seismic OBE, and one SBA) and the corresponding cycle input values that were considered in the fatigue analyses for calculating the CUF values documented in LRA Table 4.6-1 for the suppression chamber and vent system, and that will be monitored using the Fatigue Monitoring Program, and (2) clarified that the transient cycles from required controlling events (i.e., SRV actuations and seismic OBE) are included in LRA Table 4.3-1 and will be monitored using the Fatigue Monitoring Program. The staff's concern described in RAI 4.6.1-3 is resolved.

The staff also reviewed the applicant's descriptions of the Fatigue Monitoring Program, in LRA Sections B.1.17 and A.1.17, credited as the AMP in the disposition of the TLAA. The staff noted that the applicant will use its Fatigue Monitoring Program, which with enhancements and an exception, is consistent with the 10 elements of GALL Report AMP X.M1 "Fatigue Monitoring," to manage aging effects due to fatigue of the containment suppression chamber and vent system by monitoring applicable transients (i.e., SRV actuations and seismic OBE) against analysis input values tabulated in LRA Table 4.3-1 through the period of extended operation. The Fatigue Monitoring Program accomplishes this by monitoring applicable transients against analysis input values tabulated in LRA Table 4.3-1 through the period of extended operation and requires corrective action if the number of cycles approach analyzed values prior to exceeding the number of transient cycles assumed in the fatigue evaluation. LRA Sections A.1.17 and B.1.17 state that the Fatigue Monitoring Program monitors and tracks plant transients that cause significant fatigue usage for components identified to have a fatigue TLAA and, therefore, the program includes the containment suppression chamber (torus) and vent system in its scope. The staff thus determined that the Fatigue Monitoring Program, with enhancements and an exception, ensures that the number of transients assumed in the fatigue analysis of the Fermi 2 Mark I containment suppression chamber (torus) and vent system will not be exceeded during the period of extended operation or that corrective actions are taken to ensure that the code allowable limit for CUF of 1.0 is not exceeded. The staff's evaluation of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue from applicable plant transients on the intended functions of the Fermi 2 Mark I containment suppression chamber (torus) and vent system will be adequately managed for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.3 because the applicant's Fatigue Monitoring Program, with enhancements and exception, monitors applicable transient cycles on the Fermi 2 Mark I containment suppression chamber (torus) and vent system, and requires corrective action prior to exceeding the allowable transient limits used in the fatigue evaluation to ensure that the design CUF limit of 1.0 is not exceeded during the period of extended operation.

4.6.1.3 UFSAR Supplement

LRA Section A.2.4 provides the UFSAR supplement summarizing the TLAAs for the Mark I containment suppression chamber (torus) and vent system. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided an UFSAR 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 UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAAs of the Mark I containment suppression chamber (torus) and vent system, as required by 10 CFR 54.21(d).

4.6.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the primary containment suppression chamber (torus shell, welds) and the containment vent system (vent header, welds) will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.2 Vent Line Bellows

4.6.2.1 Summary of Technical Information in the Application

LRA Section 4.6.2 describes the applicant's TLAA related to fatigue evaluation of the vent line bellows of the Fermi 2 Mark I containment. The applicant stated that the "vent line bellows were specified to be qualified for at least 500 cycles of bellows expansion from the drywell and torus temperature increase following an accident, 600 cycles from [OBE], and 300 cycles from [SSE]." The applicant also stated that through its calculation it determined that the bellows were qualified for over 6,000 cycles. Since accident or earthquake cycles have not occurred at the plant, the applicant concluded that the vent line bellows fatigue analysis remains valid for the period of extended operation.

The applicant dispositioned the TLAA for the fatigue analysis of vent line bellows in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.6.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the fatigue design of Fermi 2 containment vent line 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. The SRP-LR states that the reviewer compares the number of assumed transients used in the existing calculations for the current operating term to the extrapolation to 60 years of operation of the number of operating transients experienced to date. The SRP-LR also states that comparison confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

The staff noted that the design specifications of the vent line bellows required it to be qualified for at least 500 cycles of expansion from accident temperatures, 600 OBE cycles (from two OBE events stated in LRA Table 4.3-1) and 300 SSE cycles (from one SSE event), and the actual bellows design is qualified for a total of at least 6,000 cycles from accident temperature and seismic events. The staff also noted that no accident or seismic events have occurred to date at Fermi 2 and the number of transient cycles from accident temperature and seismic events specified and considered in the fatigue evaluation is conservative and there is reasonable assurance that it will not be exceeded during the period of extended operation.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis of the Fermi 2 containment vent line bellows remains valid for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because there is reasonable assurance that the number of assumed accident temperature and seismic cyclic loads in the existing fatigue analysis of vent line bellows will not be exceeded during the period of extended operation.

4.6.2.3 UFSAR Supplement

LRA Section A.2.4 provides the UFSAR supplement summarizing the TLAA for fatigue analysis of the vent line bellows. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided an UFSAR 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 UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address TLAA involving fatigue analysis of the vent line bellows, as required by 10 CFR 54.21(d).

4.6.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis for the vent line bellows remains valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.3 Refueling and Drywell Seal Bellows

4.6.3.1 Summary of Technical Information in the Application

LRA Section 4.6.3 describes the applicant's TLAA for fatigue design of refueling bellows attached to the reactor vessel near the flange, and drywell seal bellows outside of the drywell shell. The applicant stated that its calculations determined that the refueling bellows were qualified for 45,000 thermal cycles and 9,000 refueling cycles, and that the drywell seal bellows were qualified for 2,800 thermal cycles and 180,000 refueling cycles. The applicant further stated that the number of analyzed cycles are "many more than the expected number of startups and shutdowns and refueling outages through the period of extended operation." Therefore, the applicant concluded that the bellows analyses remains valid for the period of extended.

The applicant dispositioned the TLAAs for the refueling and drywell seal bellows in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analyses remain valid for the period of extended operation.

4.6.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA related to the fatigue design of Fermi 2 containment refueling and drywell seal 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. The SRP-LR states that the reviewer compares the number of assumed transients used in the existing calculations for the current operating term to the extrapolation to 60 years of operation of the number of operating transients experienced to date. The SRP-LR also states that comparison confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

The staff noted that Fermi 2 is on an 18-month operating cycle. The staff also noted from LRA Table 4.3-1 that the projected number of transient cycles from startup and shutdown (and refueling outage) events to the end of the period of extended operation is 234, which is significantly smaller than the number of thermal and refueling cycles for which the refueling bellows and drywell seal bellows have been qualified. Therefore, the staff finds that the number of qualified transient cycles (from startup and shutdown) and refueling events considered in the fatigue evaluation is so conservative that it will not be exceeded during the period of extended operation.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis of the refueling and drywell seal bellows remains valid for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of qualified thermal and refueling cycles in the existing fatigue analyses of the refueling and drywell seal bellows will not be exceeded during the period of extended operation.

4.6.3.3 UFSAR Supplement

LRA Section A.2.4 provides the UFSAR supplement summarizing the TLAA for the fatigue analyses of the refueling and drywell seal bellows. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided an UFSAR 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 UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address TLAA evaluations involving fatigue analyses of the refueling and drywell seal bellows, as required by 10 CFR 54.21(d).

4.6.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analyses for the refueling and drywell seal bellows remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.4 Traversing Incore Probe Penetration Bellows

4.6.4.1 Summary of Technical Information in the Application

LRA Section 4.6.4 describes the applicant's TLAA for fatigue of the penetration bellows at the TIP penetrations. The applicant stated that the fatigue analysis determined that the bellows were qualified for more than 6,900 earthquake or thermal cycles, which are "many more cycles than they are expected to experience through the period of extended operation." Therefore, the applicant concluded that the bellows fatigue analysis remains valid for the period of extended operation.

The applicant dispositioned the TLAA for the TIP penetration bellows in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.6.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA for fatigue of the penetration bellows at the TIP penetrations 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. The SRP-LR states that the reviewer compares the number of assumed transients used in the existing calculations for the current operating term to the extrapolation to 60 years of operation of the number of operating transients experienced to date. The SRP-LR also states that comparison confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

The staff noted from LRA Table 4.3-1 that the projected number of thermal transient cycles, to the end of the period of extended operation, from startup and shutdown, weekly reduction to 50 percent power, and reduction to 0 percent power events is 500. Based on its review of LRA Table 4.3-1 and Section 4.6.2, the staff noted that the number of cycles considered from two OBE seismic events is 600 cycles and no seismic events have occurred to date. Thus, the number of thermal and seismic transient cycles expected through the period of extended operation is significantly smaller than the 6,900 thermal or seismic cycles for which the TIP penetration bellows are designed. Therefore, there is reasonable assurance that the number of thermal and seismic transient cycles considered in the fatigue analysis of the TIP penetration bellows is not expected to be exceeded during the period of extended operation.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis of the Fermi 2 TIP penetration bellows remains valid for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of qualified thermal and seismic transient cycles in the existing fatigue analysis of the TIP penetration bellows will not be exceeded during the period of extended operation.

4.6.4.3 UFSAR Supplement

LRA Section A.2.4 provides the UFSAR supplement summarizing the TLAA for fatigue analysis of the TIP penetration bellows. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided an UFSAR 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 UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address TLAA evaluations of the TIP penetration bellows, as required by 10 CFR 54.21(d).

4.6.4.4 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)(i), that the fatigue analysis for the TIP penetration bellows remains valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.5 Containment Penetrations

4.6.5.1 Summary of Technical Information in the Application

LRA Section 4.6.5, as revised by the LRA annual update dated June 26, 2015, describes the applicant's TLAA for the fatigue design of the containment sleeved flued head penetrations and the associated penetration sleeve bellows.

The applicant stated that the sleeved penetration assemblies with bellows, described in UFSAR Section 3.8.2.1.3.1 and illustrated and listed (designated as Type 1 design) in UFSAR Figure 3.8-9, consist of the process pipe, guard pipe, penetration sleeve bellows, and flued head. The applicant also stated that for Class 1 piping (the Fermi 2 Group A), the design of the flued head meets the requirements for Class 1 components of ASME Code Section III, which specify a fatigue analysis that determines the CUF for the flued head. The applicant further stated that "UFSAR Figure 3.8-9 provides a cross-sectional drawing of the penetration assemblies and a listing of the penetrations that use this design (designated as Type I)." The applicant listed the CUF values (maximum value being 0.471 for feedwater A/B penetrations X-9A/B) for these flued head penetrations in LRA Table 4.6-2, calculated based on the number of transient cycles shown in the analysis input value column in LRA Table 4.3-1. The applicant concluded that Fermi 2 will manage the aging effects due to fatigue of these flued head penetrations using the Fatigue Monitoring Program (LRA Section B.1.17), which monitors the plant transients that contribute to fatigue usage.

Regarding the specification for the penetration sleeve bellows the applicant stated that the specification:

> [R]equired the bellows to be analyzed for at least 200 cycles of normal operation thermal movement and 10 faulted (accident pressure and temperature) cycles. The analysis for these bellows determined they were capable of handling the movement from many more normal operation or faulted cycles than were

specified. The bellows are qualified for more than the projected number of startups and shutdowns; therefore, the bellows analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The applicant dispositioned the TLAAs for the containment flued head penetrations in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of aging due to fatigue on the intended functions will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The applicant also dispositioned the TLAA for the sleeved penetration assembly bellows in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.6.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA for fatigue design of the containment sleeved flued head penetrations and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.3. The SRP-LR states that the applicant's proposed AMP is reviewed to ensure that the effects of aging on the component's intended functions are adequately managed for the period of extended operation.

The staff noted that the CUF values listed in LRA Table 4.6-2 for different flued head penetrations are less than the code allowable limit of 1.0, and were calculated based on the number of cycles of applicable transients shown in the "Analysis Input Value" column in LRA Table 4.3-1, "Analyzed Transients with Projections," which included two OBE events. Further, the staff noted that Fermi 2 will manage the aging effects due to fatigue of these penetrations using the Fatigue Monitoring Program described in LRA Section B.1.17. However, it was not clear which specific transient events in LRA Table 4.3-1 and corresponding analysis input values were used in calculating the CUFs documented in LRA Table 4.6-2 for flued head penetrations and will be monitored by the Fatigue Monitoring Program. By letter dated January 14, 2015, the staff issued RAI 4.6.5-1 requesting the applicant to state the specific applicable transients in LRA Table 4.3-1, and the corresponding analysis input values that were used in the design fatigue analysis for calculating the CUF values documented in LRA Table 4.6-2 for flued head penetrations and that will be monitored using the Fatigue Monitoring Program.

In its response letter dated February 12, 2015, the applicant stated that the "containment penetrations were originally analyzed (n_{design}) for 250 cycles (300 cycles for [penetration] X-9A/B) of bounding transient events and attached piping loads." For purposes of projecting the number of cycles (n_{60}) to 60 years of operation (i.e., analysis input values column in LRA Table 4.3-1), the applicant categorized the Fermi 2 containment flued head penetrations into three groups and provided a table listing the bounding transient events and the projected analysis cycle input values for each group. The transient events and transient cycle analysis input values provided in the applicant's response for the feedwater penetrations X-9A/B, with the highest CUF values, are listed in Table 4.6.5-1 below.

Table 4.6.5-1 Transients Considered for Feedwater A/B Penetrations X-9A/B

Events for Penetrations X-9A/B	LRA Table 4.3-1 Event Number	Plant Condition	n_{design}, Cycles (original design)	n_{60}, Cycles (60-year projected analysis input value in LRA Table 4.3-1)
Startup	3	normal/upset	120	246
Shutdown	15-17	normal/upset	111	246

Events for Penetrations X-9A/B	LRA Table 4.3-1 Event Number	Plant Condition	n_{design}, Cycles (original design)	n_{60}, Cycles (60-year projected analysis input value in LRA Table 4.3-1)
Pre-Op Blowdown	21	normal/upset	10	3
Loss of FW Pumps	22	normal/upset	5	13
Scram-Turbine Generator Trip	10	normal/upset	40	12
Loss of FW Heaters-Turbine Trip with 100% Bypass	8	normal/upset	10	10
OBE (assumed to act concurrently with other transients)	no event number assigned	normal/upset	300	530 (from response to RAI 4.6.1-2 in SER Section 4.6.1)

The staff finds the response to RAI 4.6.5-1 acceptable because the applicant identified the specific applicable transient events in LRA Table 4.3-1 and the corresponding projected analysis (cycle) input values that were used in the design fatigue analysis for calculating the CUF values documented in LRA Table 4.6-2 for flued head penetrations, and which will be monitored using the Fatigue Monitoring Program. The staff's concern described in RAI 4.6.5-1 is resolved.

The staff also reviewed the applicant's descriptions of the Fatigue Monitoring Program, in LRA Section B.1.17 and LRA Section A.1.17, credited as the AMP in the disposition of the TLAA. The staff noted that the applicant will use its Fatigue Monitoring Program, which with enhancements and an exception described in LRA Section B.1.17 is consistent with the 10 elements of GALL Report AMP X.M1, "Fatigue Monitoring," to manage aging effects due to fatigue of the containment flued head penetrations. The Fatigue Monitoring Program accomplishes this by monitoring applicable transients against analysis input values listed in LRA Table 4.3-1 through the period of extended operation and by also requiring corrective action if the number of cycles approach analyzed values prior to exceeding the limit number of transient cycles in the fatigue evaluation. LRA Sections A.1.17 and B.1.17 state that the Fatigue Monitoring Program monitors and tracks plant transients that cause significant fatigue usage for components identified to have a fatigue TLAA; therefore, the program includes the containment flued head penetrations in its scope. The staff thus determined that the Fatigue Monitoring Program, with enhancements and an exception, ensures that the number of transients assumed in the fatigue analysis of the flued head penetrations will not be exceeded during the period of extended operation and that corrective actions are taken to ensure that the code allowable limit for CUF of 1.0 is not exceeded. The staff's evaluation of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the containment flued head penetrations will be adequately managed for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.3 because the applicant's Fatigue Monitoring Program, with enhancements and an exception, monitors applicable transient cycles on the flued head penetrations and requires corrective action prior to exceeding the allowable transient limits used in the fatigue evaluation to ensure that the design CUF limit of 1.0 is not exceeded during the period of extended operation.

The staff also reviewed the applicant's TLAA in LRA Section 4.6.5 for fatigue evaluation of the containment penetration sleeve 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. The SRP-LR states that the reviewer compares the number of assumed transients used in the existing calculations for the current operating term to the extrapolation to 60 years of operation of the number of operating transients experienced to date. The SRP-LR also states that comparison confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

The staff noted the applicant's statement that the design specification for the penetration sleeve bellows required it to be analyzed for at least 200 cycles of normal operation thermal movement and 10 faulted (accident pressure and temperature) cycles. However, without providing the actual number of transient cycles, the applicant claimed that the analysis for these bellows determined they were capable of handling the movement from many more normal operation or faulted cycles than were specified. The staff needed this information to verify that the bellows analysis remains valid for the period of extended operation. Therefore, by letter dated January 14, 2015, the staff issued RAI 4.6.5-2 requesting the applicant to state the number of normal operation and/or faulted transient cycles that the penetration sleeve bellows were determined to be capable of handling by the bellows' design fatigue analysis.

In its response letter dated February 12, 2015, the applicant stated that the "containment penetration bellows are installed to accommodate the differential movement between the drywell nozzle pipe and the flued head anchor." The applicant also stated that these bellows were originally designed for 200 cycles of cold to normal operating thermal movement, 10 cycles of cold to faulted thermal movement, and that most penetration bellows were analyzed for 4 cycles of compression/extension during installation. The applicant further stated that for the most limiting penetration bellows, more than 3,000 cycles of cold to normal operating thermal movement would be required to reach the allowable CUF value of 1.0. Therefore, the applicant concluded that the "permissible number of cycles is an order of magnitude greater than the number of startup and shutdown cycles expected through the period of extended operation."

The staff noted that, although faulted thermal movements are not required to be considered in a fatigue analysis by ASME Code Section III, the penetration bellows analysis included 10 cycles of cold to faulted thermal movement. Further, the applicant's response indicated that, for the predominant cold to normal operating thermal transient applicable to the fatigue analysis, the allowable number of transient cycles is over 3,000, which is an order of magnitude larger than the expected number of thermal cycles from startup and shutdown events (i.e., 234 from LRA Table 4.3-1) during the period of extended operation. The staff finds the applicant's response to RAI 4.6.5-2 acceptable because the applicant provided the allowable number of thermal transient cycles (i.e., 3,000) for the limiting penetration bellows, which is significantly larger than the expected number of thermal cycles through the period of extended operation; therefore, the fatigue analysis of the penetration sleeve bellows remains valid for the period of extended operation. The staff's concern described in RAI 4.6.5-2 is resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis of the containment penetration sleeve bellows remains valid for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of assumed thermal cycles, in the existing fatigue analyses of the penetration sleeve bellows will not be exceeded during the period of extended operation.

4.6.5.3 UFSAR Supplement

LRA Section A.2.4 provides the UFSAR supplement summarizing the TLAA for the fatigue analyses of the containment flued head penetrations and sleeved penetration assembly bellows. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided an UFSAR 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 UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address TLAA evaluations of flued head penetrations and sleeved penetration assembly bellows, as required by 10 CFR 54.21(d).

4.6.5.4 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)(i), that the fatigue analysis for the containment sleeved penetration assembly bellows remains valid for the period of extended operation. The staff also concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the containment flued head penetrations will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluations, as required by 10 CFR 54.21(d).

4.7 Other Plant-Specific TLAAs

4.7.1 Erosion of the Main Steam Line Flow Restrictors

4.7.1.1 Summary of Technical Information in the Application

LRA Section 4.7.1 describes the applicant’s TLAA for erosion of the main steam line flow restrictors. The LRA states that “the main steam line flow restrictors are fabricated from stainless steel and that only very slow erosion is expected to occur over time.” The LRA also states that UFSAR Section 5.5.4.4 summarizes the existing analysis of the effect of this erosion on flow restriction. The LRA further states that UFSAR Section 5.5.4.4 “postulates that even with an erosion rate of 0.004 inches per year, the increase in choked flow through the restrictors after 40 years of operation would be no more than 5 percent.” The erosion rate was re-evaluated and a new erosion rate was established for the period of extended operation. The LRA new erosion rate is based on the specific material of the flow restrictors and operation of the main steam lines with flow velocities that would be present following an EPU. Based on recalculating the analysis with the new erosion rate and a time frame of 60 years, the LRA states that the choked flow will remain within the 5 percent limit specified in UFSAR Section 5.5.4.4.

The applicant dispositioned the TLAA for erosion of the main steam line flow restrictors in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.7.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA evaluation for erosion of the main steam line flow restrictors and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the staff is to review the results of the applicant's revised analysis to verify that the evaluation period has been extended, such that the analysis is valid for the period of extended operation. The SRP-LR also states that the applicant may recalculate the analysis using a 60-year period to show that the acceptance criteria continue to be satisfied for the period of extended operation. In addition, the SRP-LR states that the applicant may revise the analysis by recognizing and re-evaluating any overly conservative conditions and assumptions.

Based on its review of UFSAR Section 5.5.4.4, the staff determined that the particular acceptance criteria for the analysis is to have no more than a 5 percent increase in the choked flow rate as a result of erosion of the main steam line flow restrictors. The staff determined that the erosion rate of 0.004 inch per year, provided in UFSAR Section 5.5.4.4, results in a total of 0.160 inch of erosion after 40 years of operation. The staff noted that the applicant revised the existing analysis to show that the acceptance criteria will continue to be met through the period of extended operation. The applicant's revised analysis is based on a 60-year period and a re-evaluation of the overly conservative assumption concerning the erosion rate. The staff found this approach to be acceptable because it is consistent with the guidelines in SRP-LR Section 4.7.3.1.2.

Because the LRA did not provide certain details concerning the results and methodology for the revised analysis, the staff determined that the applicant had not satisfactorily demonstrated that the analysis has been projected to the end of the period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii). Specifically, the staff found that the LRA did not provide the new erosion rate or describe how this rate was calculated. The staff also found that the LRA did not describe how the choked flow rate was calculated or quantify by how much it will increase as a result of recalculating the analysis. As such, the staff determined that the LRA did not provide sufficient information to demonstrate that the increase in the choked flow rate will remain less than the acceptance criteria of 5 percent. By letter dated January 20, 2015, the staff issued RAI 4.7.1-1 requesting that the applicant quantify the new erosion rate and describe and justify the methodology that was used to calculate it. The staff also requested that the applicant indicate whether wall thickness measurements of the Fermi 2 main steam line flow restrictors were considered in the determination of the new erosion rate. In addition, the staff requested that the applicant quantify the increase in the choked flow rate that was determined as a result of recalculating the analysis using the new erosion rate and a time frame of 60 years. The staff also requested that the applicant indicate whether the methodology used for this particular calculation was the same as the methodology used in the existing analysis. If the methodology was different, then the staff requested the applicant to provide justification.

In its response letter dated March 5, 2015, as supplemented by letter dated May 19, 2015, the applicant stated that thickness measurements were not taken on the main steam line flow restrictor stainless steel castings and were not used to determine the new erosion rate. The new erosion-corrosion rate, provided in the applicant's response, for the flow restrictor castings is less than the original rate of 0.004 inch per year. The applicant cited a combination of design features and erosion-corrosion data to support its determination that the original erosion-corrosion rate was overly conservative. The key input used to calculate the choked flow after 60 years of operation is the new erosion-corrosion rate. The increase in flow area after 60 years of operation is determined using the new erosion-corrosion rate and used by the applicant to conclude that the increase in choked flow rate is below 5 percent, with the choked flow rate calculated using the enhanced GEH homogenous equilibrium method. The proprietary portion of the RAI response stated specific numerical values for new erosion-corrosion rate and increase in choked flow that are below 0.004 inch per year and 5 percent, respectively.

The staff reviewed the applicant's response and the impact of 60 years of operation on the increase in restrictor flow area. Based on the review of the response, the staff verified that the expected erosion-corrosion rate of the stainless steel, high chromium Grade CF8, main steam line restrictors is less than the rate stated in UFSAR Section 5.5.4.4, and the total erosion after 60 years of operation is projected to be less than 0.160 inch. The staff also verified that the projected increase in the choked flow is within the acceptance criteria of 5 percent stated in UFSAR Section 5.5.4.4. The staff's concerns described in RAI 4.7.1-1 are resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for erosion of the main steam line flow restrictors has been projected to the end of the period of extended operation. Additionally, the analysis meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the analysis re-evaluated the overly conservative assumptions in the original analysis to show that the TLAA acceptance criteria continue to be satisfied for the period of extended operation.

4.7.1.3 UFSAR Supplement

LRA Section A.2.5.1 provides the UFSAR supplement summarizing the applicant's TLAA for erosion of the main steam line flow restrictors. The staff reviewed LRA Section A.2.5.1 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the applicant is to provide a summary description for its evaluation of each TLAA. The acceptance criteria of SRP-LR Section 4.7.2.2 state that the summary description should contain information on the disposition of the TLAA for the period of extended operation and be appropriate such that later changes can be controlled by 10 CFR 50.59.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address erosion of the main steam line flow restrictors, 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)(ii), that the analysis for erosion of the main steam line flow restrictors has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.2 Determination of High-Energy Line Break Locations

4.7.2.1 Summary of Technical Information in the Application

LRA Section 4.7.2, as revised by the LRA annual update dated June 26, 2015, describes the applicant's TLAA for the fatigue of HELB locations. The LRA states that "the method used to determine intermediate locations of pipe breaks in high-energy lines includes an evaluation based on CUF [values] being less than 0.1 if other stress criteria are also met," as also stated in

UFSAR Sections 3.6.1 and 3.6.2. The LRA states that the CUF analyses used in the determination of postulated HELB locations were based on design transients assumed for the original 40-year life of the plant and are, therefore, considered TLAAs. The LRA also states that the CUF calculations were modified to account for the projected cycles for 60 years of operation and that limiting locations were reanalyzed, which resulted in these locations meeting the 0.1 CUF criteria. The LRA states that the Fatigue Monitoring Program will identify when the transients affecting high-energy piping systems are approaching their analyzed number of cycles.

The applicant dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of aging associated with fatigue on the intended functions of HELB locations 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 fatigue of HELB locations and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant proposes to manage the aging effects associated with the TLAA by an AMP in the same manner as described in the integrated plant assessment (IPA) in 10 CFR 54.21(a)(3). The SRP-LR also states that the reviewer reviews the applicant's AMP to verify that the effects of aging on the intended function(s) are adequately managed consistent with the CLB for the period of extended operation. In addition, the SRP-LR states that a license renewal applicant should identify the structures and components (SCs) associated with the TLAA.

The staff also reviewed the applicant's TLAA against the acceptance criteria in SRP-SLR Section 4.3.2.1.1.3, which state that an AMP corresponding to GALL Report AMP X.M1, "Fatigue Monitoring," may be used by the applicant to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

UFSAR Section 3.6.2 states that high-energy fluid systems include systems in which, under normal or upset plant conditions, the maximum operating temperature exceeds 200 °F or the maximum operating pressure exceeds 275 psig. UFSAR Section 3.6.2.1.2.2 establishes the criteria for identifying a given location as a HELB location. One such criterion is that any intermediate piping location between terminal ends with a CUF that exceeds an acceptance criterion value of 0.1 is identified as a HELB location. UFSAR Section 3.6.2.1.2.2 and LRA Section 4.7.2 state that postulated pipe breaks in the high-energy piping between the containment penetrations and outboard isolation valves were not postulated because the piping was conservatively designed and restrained. The staff noted that UFSAR Section 3.6.2.1.2.2 states that the piping was conservatively designed and restrained such that the transmitted pipe load during a postulated pipe break would not impair the operability of the outboard isolation valve nor affect the integrity of the piping of the containment penetration.

The applicant credits the Fatigue Monitoring Program to manage the effects of aging associated with the fatigue analyses of these postulated HELB locations through the period of extended operation. The staff's review of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8. The staff noted that as long as the number of transients that occur at the site remains bounded by the cycle limits assumed in the HELB analyses, the HELB evaluations will remain valid. The staff also noted that the applicant provided an exception to its Fatigue Monitoring Program to apply the lower CUF limit of 0.1 at HELB locations. The staff found the exception to apply a value of 0.1 as the acceptance criteria for the HELB CUF analysis was acceptable because it is in conformance with recommended acceptance criteria defined for these types of analyses in NUREG-0800 Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping." Therefore, the staff determined that the enhanced Fatigue Monitoring Program, with an exception, ensures that (1) the number of transients will not be exceeded during the period of extended operation and (2) corrective actions are taken such that the impact of cracking by fatigue or cumulative fatigue damage on the intended functions of the ASME Code Class 1 components analyzed in the HELB analyses will be adequately managed during the period of extended operation.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to fatigue on the intended functions of the HELB locations will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Sections 4.7.2.1 and 4.3.2.1.1.3 because: (a) the applicant has adequately demonstrated that the Fatigue Monitoring Program provides an acceptable basis for managing the impact of cracking by fatigue or cumulative fatigue damage on the intended functions of the ASME Code Class 1 components analyzed in the HELB locations, and (b) this is consistent with bases for accepting these types of TLAAs in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.2.3 UFSAR Supplement

LRA Section A.2.5.2 provides the UFSAR supplement summarizing the TLAA for HELB postulated locations based on CUF. The staff reviewed LRA Section A.2.5.2 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the information to be included in the UFSAR supplement should include a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for HELB postulated locations based on CUF, 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 on the intended functions of the HELB postulated locations will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.3 Jet Pump Auxiliary Spring Wedge Assembly

4.7.3.1 Summary of Technical Information in the Application

LRA Section 4.7.3 describes the applicant's TLAA for the loss of preload of the jet pump auxiliary spring wedge assemblies installed on jet pumps 1, 2 and 15. The LRA states that the auxiliary spring wedge assemblies will experience a loss of spring preload due to exposure to neutron fluence. The applicant also stated that the original evaluation of this loss of preload considered a fluence of 1.2×10^{20} n/cm^2 for a 40-year design life. The LRA states that the applicant re-evaluated the fluence to the end of the period of extended operation and determined that the projected neutron fluence for one of the spring wedge assemblies would exceed the original design fluence by 4 percent, and determined that this increase in fluence would result in an increase in preload loss. Based on recalculating the analysis with the new fluence and a period of 60 years, the LRA states that higher fluence will have no adverse impact on the structural integrity and functional performance of the spring wedge assembly.

The applicant dispositioned the TLAA for the loss of preload of the jet pump auxiliary spring wedge assembly in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.7.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the jet pump auxiliary spring wedge assembly and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the applicant may recalculate the analysis using a 60-year period to show that the acceptance criteria continue to be satisfied for the period of extended operation. The SRP-LR also states that the applicant may revise the analysis by recognizing and re-evaluating any overly conservative conditions and assumptions. However, the staff's review of this TLAA found that the applicant did not provide sufficient basis for the conclusion of the capability of the component to perform its intended function; therefore, the staff determined that the LRA did not properly describe this TLAA. By letter dated January 14, 2015, the staff issued RAI 4.7.3-1 requesting the applicant provide additional information on the following items to support the conclusion that an increased loss of preload due to an increase in projected fluence will have no adverse impact on the intended function of the spring wedge assembly. The RAI requested information on (1) how preload ensures functional performance and the amount of preload that ensures functionality of the spring wedge assemblies, (2) justification for and methodology used to calculate spring wedge assembly neutron fluence through the end of the period of extended operation, (3) the methodology used to calculate loss of preload and how it is different from the original methodology, and (4) the amount of preload loss calculated to the end of the period of extended operation and how that value compares to the amount needed to ensure functional performance of the spring wedge assembly.

In its response letter dated February 12, 2015, the applicant stated the following:

(1) In response to how preload ensures functional performance of the spring wedge assembly, the applicant stated that the component is designed to function with any magnitude of preload.

(2) Regarding the methodology used to calculate spring wedge assembly fluence, the applicant stated it used NRC approved methodology in Licensing Topical Report (LTR) NEDC-32983P-A that the NRC staff determined was acceptable as a best-estimate prediction of the fast neutron flux for BWR pressure vessel and internal components. Additionally, the applicant stated that the neutron fluence is calculated using conservative assumptions, including (a) calculated end-of-life fluence using the peak flux for each wedge, (b) "the operating history that included the historical and projected reactor power level and the associated time," and (c) a capacity factor of 100 percent to ensure a conservative end-of-life fluence of 52 effective full power years.

(3) Regarding the description of the methodology used to calculate loss of preload, the applicant stated that the reanalysis methodology is the same as the original methodology and attributes loss of preload to wedge material stress relaxation due to

neutron fluence at reactor operating temperature and potential plastic deformation during installation.

(4) When quantifying the amount of preload loss calculated to the end of the 60-year period and comparing that value to the amount needed to ensure functional performance of the spring wedge assembly, the applicant stated that the new calculated amount of expected preload loss is only slightly higher than originally projected for the end of the current operating period. Additionally, the applicant showed that the total amount of spring preload projected to the end of the period of extended operation is more than the amount needed in the most limiting case, where the friction forces between the wedge and associated restrainer bracket must be greater than the maximum combined loads applicable to the auxiliary spring wedge assembly.

The staff finds the applicant's response to RAI 4.7.3-1 Parts 1-4 acceptable because it provided proprietary values regarding the design preload, expected loss of preload, and loss of preload projected to the end of the period of extended operation, using staff-approved fluence methodology for 52 EFPY, for the jet pump auxiliary spring wedge assembly. The response showed that these projected values are within the minimum preload limits used as acceptance criteria for the spring wedges. Therefore, the staff finds the applicant has appropriately projected the analysis to the end of the period of extended operation. The information provided regarding how functionality of the spring wedge is ensured, how flux was calculated, how stress relaxation was analyzed, and how the final amount of preload compares to the amount needed to ensure functionality, consists of a sufficient description of the analysis and conclusions for this TLAA. The staff's concerns described in RAI 4.7.3-1 are resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the auxiliary spring wedge assemblies has been projected to the end of the period of extended operation. The staff finds that the applicant provided the appropriate fluence and loss of preload projections to demonstrate that it projected the analysis to the end of the period of extended operation and that the reanalysis still meets the applicant's limit on preload loss. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.3.1.2 because the applicant has provided a sufficient description of the analysis and conclusions to show that they are satisfactory for the period of extended operation.

4.7.3.3 UFSAR Supplement

LRA Section A.2.5.3 provides the UFSAR supplement summarizing the TLAA for loss of preload in jet pump auxiliary spring wedge assemblies. The staff reviewed LRA Section A.2.5.3 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the UFSAR supplement provides a summary description of the evaluation of the TLAA.

The staff's review of this UFSAR supplement found that the applicant did not provide a sufficient summary description of this TLAA. By letter dated January 14, 2015, the staff issued RAI 4.7.3-2 requesting the applicant to provide additional information regarding (1) which auxiliary spring wedge assemblies are addressed in the analysis and which assemblies represent the most limiting case, (2) the acceptance criteria used to determine how functionality of the spring wedge is ensured, and (3) the results of the analysis in terms of the amount of preload loss and how those results compare to the acceptance criteria.

In its response dated February 12, 2015, the applicant revised LRA Section A.2.5.3 to include the following information:

(1) Auxiliary spring wedges are installed on jet pumps 1, 2, and 15, and are designed to "maintain continuous three-point contact for the inlet mixer to the restrainer bracket."

(2) The wedge installed on jet pump 1 was determined to be the most limiting, with its projected neutron fluence slightly exceeding the design fluence when projected to the end of the period of extended operation.

(3) "The results of the analysis demonstrated that the available preload at the end of the period of extended operation is considerably greater than the required preload. Additionally, the auxiliary spring wedge assembly is designed to function independent of the spring preload i.e. the spring wedge function works at any preload. There will be contact between the belly band, auxiliary spring wedge assembly, and the restrainer bracket."

The staff finds this response acceptable because the amendments to the UFSAR supplement section provided additional specific details on (a) how the jet pump assemblies are designed, (b) which of the jet pump auxiliary spring wedge assemblies in the plant design was the limiting assembly for the loss of preload TLAA, and (c) how preload is used to ensure that the jet pump auxiliary spring wedge assemblies will maintain their integrity during the period of extended operation. The staff's concerns described in RAI 4.7.3-2 are resolved.

Based on its review of the UFSAR supplement, as amended by letter dated January 14, 2015, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the loss of preload in jet pump auxiliary spring wedge assemblies TLAA, 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)(ii), that the analysis for loss of preload in jet pump auxiliary spring wedge assemblies has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.4 Jet Pump Slip Joint Repair Clamps

4.7.4.1 Summary of Technical Information in the Application

LRA Section 4.7.4 describes the applicant's TLAA for loss of preload of the jet pump slip joint repair clamps. The LRA states that the slip joint repair clamps are connected to the diffuser and the mixer (throat) in the jet pump assembly. The LRA states that the original analysis of the clamps used a stress relaxation of 5 percent, due to neutron fluence. A fluence analysis was performed at the clamp location for 52 EFPY of plant operation, including MUR/TPO. The LRA also states that the fluence analysis produced a value of 3.07×10^{18} n/cm^2 (E > 1 MeV), which is below the threshold of 1×10^{19} n/cm^2 to cause stress relaxation in stainless steel from neutron irradiation. Based on the neutron irradiation level, the applicant concludes that the original relaxation value remains valid and the stress report results remain applicable for the period of extended operation.

The applicant dispositioned the TLAA for the jet pump slip joint repair clamps in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.7.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the jet pump slip joint repair clamps and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the staff is to review and verify that the revised analyses are valid for the period of extended operation. The SRP-LR also states that the applicant may recalculate the TLAA using a 60-year period to show that the TLAA acceptance criteria continue to be satisfied during the period of extended operation.

The LRA states that the clamps were installed with a preload that may decrease due to neutron fluence and thermal exposure. The LRA also states that the analysis that evaluated the decrease of the installation preload for the slip joint repair clamp is a TLAA that has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). However, the staff lacked sufficient information to evaluate the jet pump slip joint repair clamp TLAA for the period of extended operation and determine if the UFSAR supplement, LRA Section A.2.5.4, adequately summarizes the TLAA in accordance with 10 CFR 54.21(d). By letter dated December 23, 2014, the staff issued RAI 4.7.4-1 requesting that the applicant provide (1) a functional description of the clamps, (2) a physical description of the clamps, and (3) summaries of the analysis used to evaluate the jet pump slip joint repair clamps during the period of extended operation.

In its response dated February 5, 2015, the applicant stated that the intended function of the slip joint clamp is to provide a lateral preload that restrains the motion of the jet pump inlet mixer relative to the diffuser collar to suppress abnormal jet pump vibration. The loss of preload, below a minimum design value, would preclude the clamp from performing this function. The applicant also provided drawings referenced from site procedures to show the physical characteristics of the clamp. The applicant stated that a relaxation evaluation was performed for the slip joint clamp to determine if the original structural evaluation would remain valid for the period of extended operation (52 EFPY). The analysis used to determine the level of neutron irradiation exposure (fluence) that the clamps will experience is described in Section 2.1 of NEDC-32983P-A, "Licensing Topical Report General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," Revision 2, dated January 2006, which is approved by the staff and consistent with RG 1.190. The neutron fluence analysis was performed, using the conservative assumption that the clamps have been installed since the beginning of plant life, and produced a value of 3.07×10^{18} n/cm^2 for 52 EFPY. The threshold value of 1×10^{19} n/cm^2, to cause stress relaxation in stainless steel from neutron irradiation, was taken from design curves in the GE BWR Materials Handbook. The design curves are the result of the statistical treatment of empirically established stress relaxation curves that have been developed and verified by the GEH Materials Engineering Group. The applicant concluded that the original analysis and results of the stress report remain applicable during the period of extended operation because the flux experienced by the jet pump slip joint repair clamps will remain below the threshold value to cause stress relaxation.

The staff reviewed the applicant's response and finds it acceptable because (1) the neutron fluence experienced by the jet pump slip joint repair clamps (3.07×10^{18} n/cm^2) will remain below the threshold value (1×10^{19} n/cm^2) necessary to cause stress relaxation, (2) the neutron flux analysis used to determine the neutron fluence in the relaxation evaluation is a staff-approved methodology, (3) the applicant provided physical and functional descriptions of the jet pump slip joint repair clamps, and (4) the jet pump slip joint repair clamps will not experience a loss of preload during the period of extended operation and will maintain their intended function. The staff's concerns described in RAI 4.7.4-1 are resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the jet pump slip joint repair clamps has been projected to the end of the period of extended operation and remains valid. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the fluence analysis has been projected to the end of the period of extended operation and has been shown to have no impact on the original stress relaxation evaluation for the jet pump slip joint repair clamps.

4.7.4.3 UFSAR Supplement

LRA Section A.2.5.4 provides the UFSAR supplement summarizing the evaluation of the loss of preload due to neutron irradiation for the jet pump slip joint repair clamps. The staff reviewed LRA Section A.2.5.4 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the staff verifies that the applicant has provided information in the UFSAR supplement that includes a summary description of the TLAA. The SRP-LR also states that the TLAA should contain information on how it has been dispositioned for the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address loss of preload for the jet pump slip joint repair clamps, 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)(ii), that the stress relaxation analysis for the jet pump slip joint repair clamps has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.5 Flaw Evaluations for the Reactor Pressure Vessel

4.7.5.1 Summary of Technical Information in the Application

LRA Section 4.7.5 describes the applicant's TLAA for a fracture mechanics evaluation performed to determine the acceptability of the RPV flaw indications. The LRA states that "during refueling outage 9 (RF9) in 2003, new ASME Code Section XI, Appendix VIII, qualified ultrasonic examination procedures were used for the first time on [RPV] welds." These new techniques greatly improved flaw detection and sizing capabilities and detected several flaws that had not been detectable previously. The LRA also states that a re-examination in refueling outage 12 in 2009 using phased-array technique identified flaws at two additional RPV locations. A fracture mechanics analysis evaluated the bounding flaw location to determine the acceptability of the RPV flaw indications for consideration of the P-T analysis. The LRA further states that "the analysis determined the indications are acceptable for 52 EFPY with consideration of the effects of MUR/TPO."

The applicant dispositioned the TLAA for the RPV flaws in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.7.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the RPV flaw indications and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the results of the analysis should be reviewed to verify that they are valid for the period of extended operation. The SRP-LR also states that the applicant may calculate the analysis using the 60-year period to demonstrate that the acceptance criteria continue to be satisfied for the period of extended operation. In addition, the SRP-LR states that the applicant should provide a sufficient description of the analysis and document the results of the reanalysis to demonstrate that it is satisfactory for the 60-year period.

In its review, the staff noted the following related to the applicant's flaw analysis for the CLB. The applicant's evaluation of the reactor vessel flaws for the current license period (32 EFPY) is described in GE Report NEDO-33133, Revision 0, "Pressure-Temperature Curves for DTE Energy Fermi Unit 2," dated February 2005 (ADAMS Accession No. ML050870587); and in GE Report NEDO-33785, Revision 0, "DTE Energy/Enrico Fermi Power Plant 2 Pressure and Temperature Limits Report Up to 24 and 32 Effective Full-Power Years," dated October 2012 (ADAMS Accession No. ML13004A135). The evaluation used the bounding flaw (flaw No. 124) which is 2 inches in length and 4.24 inches in depth and is at a 374.6-inch elevation above the vessel 0 foot elevation. Based on the evaluation of the bounding flaw (flaw No. 124), the applicant's evaluation concludes that the projected fatigue growth of the flaws for the current license period is minimal (0.04 inch) and the detected flaws are acceptable for the current license period.

The staff also noted that the applicant performed an analysis of the flaws for the period of extended operation. During its audit, the staff reviewed the applicant's analysis and confirmed that the bounding flaw (flaw No. 124) for the current license period still remains the bounding flaw for the period of extended operation. The staff further noted that the applicant's analysis concludes that the projected flaw growth during the period of extended operation is very minimal (0.02 inch) and the detected flaws are also acceptable through the period of extended operation. In addition, the staff confirmed that the applicant's TLAA adequately accounts for the design requirements for the RPV. Specifically, the staff noted that the applicant's analysis of the bounding flaw ensures that the bounding flaw meets the requirements of the design specification and the ASME Code for the RPV through the period of extended operation.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the RPV has been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the applicant projected the fracture mechanics analysis of the RPV flaws to the end of the period of extended operation.

4.7.5.3 UFSAR Supplement

LRA Section A.2.5.5 provides the UFSAR supplement summarizing the TLAA for the fracture mechanics evaluation of the RPV flaws. The staff reviewed LRA Section A.2.5.5 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the following is to be confirmed: (a) the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of each TLAA, and (b) each such summary description is appropriate such that later changes can be controlled by 10 CFR 50.59. The SRP-LR also states that the description should contain information that the TLAA has been dispositioned for the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the fracture mechanics evaluation of the RPV flaws, as required by 10 CFR 54.21(d).

4.7.5.4 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)(ii), that the fracture mechanics analysis for the RPV flaws has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.6 Main Steam Bypass Lines Cumulative Operating Time

4.7.6.1 Summary of Technical Information in the Application

LRA Section 4.7.6 describes the applicant's TLAA for the main steam bypass lines cumulative operating time. The LRA states that in accordance with Detroit Edison's letter to NRC, dated November 7, 1986 (ADAMS Legacy Library Accession No. 8611170335), the cumulative time that the main steam bypass lines are operated with the bypass valves configured in the 30-percent to 45-percent open position will be reported to the NRC annually. The LRA also states that the cumulative value of 100 days of operation shall not be exceeded without prior notification to the NRC.

The LRA states that an evaluation of a postulated flaw was performed that concluded that the main steam bypass lines are acceptable for continued service provided that the lines are operated within the constraints (100 days of total operation with bypass valves in the 30-percent to 45-percent open position). The LRA states that based on this evaluation, the main steam bypass lines have a service life that will allow them to operate for the life of the plant, including the period of extended operation. The LRA further states that tracking of the cumulative operating time of the main steam bypass lines will be as shown in LRA Table 4.3-1, and it will be continued for the period of extended operation. LRA Table 4.3-1 provides a projection of the number of days (i.e., 98 days) the main bypass lines will be operated with the bypass valves in the 30-percent to 45-percent open position through 60 years of operation. The applicant stated that it will monitor this usage to "ensure this limit is maintained or that it is reanalyzed or that inspections are performed as required."

The applicant dispositioned the TLAA for the main steam bypass line in accordance with 10 CFR 54.21(c)(1)(iii), to demonstrate that the effects of the cumulative operating time on the intended functions will be adequately managed by the Fatigue Monitoring Program for the period of extended operation.

4.7.6.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the main steam bypass lines and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant can propose to manage the aging effects associated with the TLAA by an AMP as described in the IPA in 10 CFR 54.21(a)(3). The SRP-LR also states that the reviewer verifies that the effects of aging on the intended function(s) are adequately managed consistent with the applicant's CLB for the period of extended operation.

The staff also reviewed the applicant's evaluation dated October 16, 1986, "Service Life of Main Steam Bypass Line" (ADAMS Legacy Library Accession No. 8610220177). The staff verified that the limiting input value from the applicant's original evaluation is 100 days, as identified in LRA Table 4.3-1. The staff noted that the projected operating time through the end of the period of extended operation, 98 days, is bounded by the analyzed limit of 100 days. The staff noted that the applicant has credited its enhanced Fatigue Monitoring Program to track the cumulative operating time of the main steam bypass line during the period of extended operation. The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.8.

The staff finds that the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative operating time on the intended functions of the main steam bypass lines will be adequately managed for the period of extended operation. Additionally, the applicant's demonstration meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the Fatigue Monitoring Program will monitor the cumulative operating time of the main steam bypass lines to ensure that, if the established limit is approached, corrective action is taken prior to exceeding the limit.

4.7.6.3 UFSAR Supplement

LRA Section A.2.5.6 provides the UFSAR supplement summarizing the main steam bypass line cumulative operating time TLAA. The staff reviewed LRA Section A.2.5.2 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer verifies that the applicant has provided an adequate summary description in its UFSAR supplement of the evaluation of its TLAAs for the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant has provided an adequate summary description of its actions to address the main steam bypass lines TLAA, as required by 10 CFR 54.21(d).

4.7.6.4 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 cumulative operating time on the main steam bypass lines will be adequately managed by the Fatigue Monitoring Program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the main steam bypass line TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.7 Crane (Heavy Load) Cycles

4.7.7.1 Summary of Technical Information in the Application

LRA Section 4.7.7 describes the applicant's TLAA related to the crane (heavy load) cycles for the reactor building crane. The LRA states that the reactor building crane meets the structural guidelines of Crane Manufacturers Association of America Specification No. 70 (CMAA-70), which provides allowable stress ranges based on joint category and service class. The LRA states that the lowest range of cycles for CMAA-70 Class A cranes is 20,000 to 100,000 cycles. Because of the cycles associated with such classification, the LRA states the analysis related to the CMAA-70 lift cycle limit is considered to be a TLAA. The LRA states that the reactor building crane has a capacity of 125 tons and it is used infrequently for refueling operations, service and maintenance of the reactor, equipment moved through the equipment access lock, and will be used during decommissioning. The LRA also states that the total number of crane lifts of over 20,000 lb (10 tons), are projected to be 2,868, which they have increased by applying a 25 percent margin to arrive at a projected number of 3,585 crane lifts. The LRA further states that lifts during construction and decommissioning are considered by doubling the 3,585 lifts. Accordingly, the estimated total number of lifts for the reactor building overhead crane would be 7,170, which is below the 100,000 cycles established in CMAA-70 for Class A service cranes.

The applicant dispositioned the TLAA for the reactor building crane in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.7.7.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor building crane 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 existing analyses should be shown to be bounding even during the period of extended operation. The SRP-LR also states that the applicant should describe the TLAA with respect to the objectives of the analysis, assumptions used in the analysis, conditions, acceptance criteria, relevant aging effects, and intended functions. The applicant should show that conditions and assumptions used in the analysis already address the relevant aging effects for the period of extended operation, and that acceptance criteria are maintained to provide reasonable assurance that the intended functions are maintained for renewal, concluding that no reanalysis is necessary for renewal.

The staff reviewed UFSAR Section 9.1, "Fuel Storage and Handling," of the UFSAR and confirmed that the crane is used in a multifunctional role for refueling, and dry fuel cask loading and movements, as described in the LRA. In its review of the UFSAR, the staff confirmed that the lifting capacity of the crane in its current state and configuration is designed to accept loads of not more than 125 tons. The staff also confirmed the crane is designed in accordance with the requirements of the Electric Overhead Crane Institute No. 61 (EOCI-61), "Specifications for Electric Traveling Cranes," Class A service and that it meets the structural guidelines of CMAA-70, which is recognized as the design code of record. The staff noted that the reactor building crane meets the provisions and guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," dated July 1980 (ADAMS Accession No. ML070250180). The staff also noted that NUREG-0612 Section 4.0, "Historical Records of Crane Operations," indicates that the average number of lifts per crane is 500 or less per year.

The staff reviewed EOCI-61 and CMAA-70 Class A specifications and confirmed that the crane's classification as stated in the LRA and the UFSAR is for standby service cranes used very infrequently, for loads in powerhouses, utilities, turbine rooms, and where precise handling at slow speeds is needed. In its review of the CMAA-70, Class A specifications, the staff also confirmed that in the definition of loading conditions and stress category classifications, fatigue becomes a concern when cranes have 20,000 to 100,000 lift cycles.

The applicant identified in the LRA that this crane will have experienced a total of 7,170 lifts during construction, operation to the end of the period of operation, and decommissioning. Based on this projected number of cycles, the staff concludes that the analysis remains valid during the period of extended operation.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the reactor building crane remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the applicant has demonstrated that the projected load cycles over 60 years of operation will not exceed the CMAA-70 allowable load cycles for Class A service cranes.

4.7.7.3 UFSAR Supplement

LRA Section A.2.5.7 provides the UFSAR supplement summarizing the analysis associated with the reactor building crane (heavy load) cycle. The staff reviewed LRA Section A.2.5.7 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that that the applicant has to provide information to be included in the UFSAR supplement that includes a summary description of the evaluation of each TLAA. The SRP-LR also states that each summary description is reviewed to verify that it is appropriate, such that later changes can be controlled by 10 CFR 50.59 and that the description should contain information that the TLAAs have been dispositioned for the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the analysis of the reactor building crane (heavy load) cycles, as required by 10 CFR 54.21(d).

4.7.7.4 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)(i), that the analysis for the reactor building crane (heavy load) cycles remains valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.8 Conclusion for TLAAs

The staff reviewed the information in LRA Section 4, "Time-Limited Aging Analyses." On the basis of its review, the staff concludes that the applicant has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3, and that the applicant has demonstrated that each of the TLAAS will meet one of the following requirements in 10 CFR 54.21(c)(1):

- The TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i).

- The TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii).
- The effects of aging on intended functions will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii).

The staff also reviewed the UFSAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2), that no plant-specific, TLAA-based exemptions are in effect.

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 made in order to comply with 10 CFR 54.21(a)(1), in accordance with the Atomic Energy Act of 1954, as amended, and in accordance with 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 Fermi 2. The U.S. Nuclear Regulatory Commission (NRC) staff (the staff) presented its safety evaluation report (SER) with open items to the ACRS Subcommittee on Plant License Renewal in a public meeting on March 2, 2016. DTE Electric Company (DTE or the applicant) and the NRC staff will meet with the full committee on September 8, 2016, to discuss the closure of the open items and other issues associated with the review of the LRA.

After the ACRS completes its review of the LRA and SER, the full committee will issue a report discussing the results of the review. An update to 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 Fermi 2 Nuclear Power Plant (Fermi 2) 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* 54.29, "Standards for Issuance of a Renewal License" (10 CFR 54.29), sets the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff determines that the requirements of 10 CFR 54.29(a) have been met.

The staff noted that any requirements of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," Subpart A, "National Environmental Policy Act – Regulations Implementing Section 102(2)," will be documented in a final, plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)," Supplement 56, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 56, Regarding Fermi 2 Nuclear Power Plant."

APPENDIX A

FERMI 2 LICENSE RENEWAL COMMITMENTS

A. Fermi 2 License Renewal Commitments

During the review of the Fermi 2 Nuclear Power Plant (Fermi 2) license renewal application (LRA) by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff), DTE Electric Company (DTE or the applicant) made commitments related to aging management programs (AMPs) to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment. The period of extended operation starts on March 21, 2025, for Fermi 2.

Table A.1-1 Appendix A: Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
1	DTE will make the following changes to the process for operating experience review. a. Procedures will be revised to add an aging type code to corrective action program documents that describe either plant conditions related to aging or industry operating experience related to aging. b. Procedures will be revised to provide for training of personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging management, as well as for personnel responsible for implementing AMPs, based on the complexity of the job performance requirements and assigned responsibilities. c. Procedures will be revised to specify that evaluations of operating experience concerning age-related degradation will include consideration of the affected systems, structures or components, the environments, materials, aging effects, aging mechanisms, and aging management programs.	A.1	Completed	LRA DTE letter NRC-15-0009 dated 1/15/15 DTE letter NRC-16-0045 dated 7/6/16
2	DTE currently performs periodic self-assessments on many aging management programs. DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of each aging management program described in the updated final safety analysis report (UFSAR) supplement. For new aging management programs, the first evaluation will be performed within 5 years of implementing the program.	A.1	Within 5 years of implementing the program for new programs.	LRA
3	Implement the new Aboveground Metallic Tanks Program that will manage loss of material and cracking for outdoor tanks within the scope of license renewal that are sited on soil or concrete. Condensate storage tank (CST) internal inspections will be conducted in accordance with Table 4a of LR-ISG-2012-02; internal inspections of the combustion turbine generator (CTG) fuel oil tank will be conducted in accordance with NUREG-1801, XI.M30. This program will also manage the bottom surfaces of both in-scope aboveground metallic tanks. Within the 10 years prior to the period of extended operation and every 10 years thereafter, a volumetric examination of a minimum 25 percent of the CST tank bottom interface with the concrete ring foundation will be performed to manage loss of material. The	A.1.1	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later. Initial inspections will be performed within the 10 years prior to March 20, 2025.	LRA DTE letter NRC-15-0005 dated 1/20/15 DTE letter NRC-15-0031 dated 4/10/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	volumetric inspection will be on a 2 inch grid or less, depending on the technology utilized.			
4	Enhance the Bolting Integrity Program as follows: a. Revise Bolting Integrity Program procedures to ensure consideration of actual yield strength when procuring bolting material. If procured, closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking. b. Revise Bolting Integrity Program procedures to state that bolting for safety-related pressure-retaining components is inspected for leakage, loss of material, cracking, and loss of preload/loss of prestress. Closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking. c. Revise Bolting Integrity Program procedures to: (1) implement applicable recommendations for pressure boundary bolting in NUREG-1339, Electric Power Research Institute (EPRI) NP-5769, and EPRI TR-104213; (2) state both American Society of Mechanical Engineers (ASME) Code class bolted connections and non-ASME Code class bolted connections are inspected at least once per refueling cycle; and (3) include volumetric examination per ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification. d. Revise Bolting Integrity Program procedures to inspect residual heat removal service water (RHRSW), emergency equipment service water (EESW), and emergency diesel generator service water (EDGSW) systems' pump and valve bolting submerged in the RHRSW reservoir at least once every refueling outage and to opportunistically inspect bolting threads during maintenance activities. e. Revise Bolting Integrity Program procedures to include the additional guidance and recommendations of EPRI NP-5769 for replacement of ASME pressure-retaining bolts and the guidance provided in EPRI TR-104213 for the replacement of other pressure-retaining bolts.	A.1.2	Prior to September 20, 2024.	LRA DTE letter NRC-15-0006 dated 1/20/15 DTE letter NRC-15-0011 dated 2/12/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	f. Revise Bolting Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR Part 50 Appendix B Quality Assurance Program. g. Revise Bolting Integrity Program procedures to perform opportunistic inspections for Control Center HVAC system safety-related pressure-retaining bolting in a lube oil external environment, including the bolting threads to ensure that loss of material in crevice locations that are not readily visible can be detected. h. Revise Bolting Integrity Program procedures to perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment.			
5	Implement the Boraflex rack replacement approved in Amendment No. 141 so that the current Boraflex panels in the spent fuel pool will not be required to perform a neutron absorption function during the period of extended operation.	A.1.3	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0081 dated 9/24/15
6	Implement new Buried and Underground Piping Program that will manage the effects of aging on the external surfaces of buried and underground piping within the scope of license renewal. Soil testing will be conducted once in each 10-year period starting 10 years prior to the period of extended operation, if a reduction in the number of inspections recommended in Table XI.M41-2of NUREG 1801 is taken based on a lack of soil corrosivity.	A.1.4	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later. Initial directed inspections and soil testing (if the reduction in inspections based on soil testing is taken) will be performed within the 10 years prior to March 20, 2025.	LRA DTE letter NRC-15-0002 dated 1/15/15 DTE Letter NRC-16-0027 dated 4/12/16
7	Enhance the BWR Vessel Internals Program as follows: a. The susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of cast austenitic stainless steel (CASS) and X-750 alloy will be evaluated. b. BWR Vessel Internals Program procedures will be revised as follows. Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility,	A.1.10	Perform initial inspection either prior to March 20, 2025, or before March 20, 2030. Submit analysis and inspection plan to the NRC prior to March 20, 2023. Remaining activities:	LRA DTE letter NRC-15-0010 dated 2/5/15 DTE letter NRC-15-0044 dated 4/27/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within 5 years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations. c. BWR Vessel Internals Program procedures will be revised as follows. In accordance with an applicant action item for BWRVIP-25 safety evaluation: (a) install core plate wedges prior to the period of extended operation, or (b) complete a plant-specific analysis that justifies no inspections are required, or (c) complete a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25. For Option (b), the analysis will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The analysis will be submitted to the NRC 2 years prior to the period of extended operation. Additionally, the UFSAR will be revised to address the analysis if it is determined to meet the criteria for a time-limited aging analysis (TLAA) at least 2 years prior to the period of extended operation. For Option (c), the analysis will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The analysis, inspection plan with acceptance criteria, and justification for the inspection plan will be submitted to the NRC 2 years prior to the period of extended operation. Additionally, the UFSAR will be revised to address the		Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	DTE letter NRC-15-0062 dated 6/9/15 DTE letter NRC-15-0083 dated 8/20/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	analysis if it is determined to meet the criteria for a TLAA at least 2 years prior to the period of extended operation. d. Revise BWR Vessel Internals Program procedures such that the flaw evaluation methodology for the top guide grid beam will address the following three items if they have not been resolved generically during the NRC review and approval process of BWRVIP-183: (1) Detected flaws evaluated using the methodology in BWRVIP-183 Section 4 will be demonstrated to be sufficiently far from geometric discontinuities (i.e., notches or slots) such that the stress condition in the vicinity of the flaw is consistent with that for a single edgecrack plate. Appropriately applied K values which account for the effects of geometric discontinuities will be used and justified in the flaw evaluation. (2) The flaw evaluation methodology in BWRVIP-183 Section 4 will be used to justify continued operation on a cycle-by-cycle basis. Use of the flaw evaluation methodology to justify operation for more than once cycle will require NRC approval and would be based on plant-specific operating experience including crack length measurements of detected top guide grid beam flaws to benchmark the accuracy of the flaw evaluation methodology. (3) When applying the flaw evaluation methodology in BWRVIP-183 Section 4, a severed beam evaluation consistent with BWRVIP-183 Section 5 will also be performed. The severed beam analysis will demonstrate that even if a beam was a completely severed beam, it would not be expected to interfere with the ability of the control rod drive system to insert control rods. e. Revise BWR Vessel Internals Program procedures to perform opportunistic inspections of the differential pressure and standby liquid control line inside the reactor vessel when the line becomes accessible.			
8	Enhance the Compressed Air Monitoring Program as follows: a. Revise Compressed Air Monitoring Program procedures to periodically sample, test, and monitor moisture and corrosive contaminants to verify parameters are within acceptable limits	A.1.11	Prior to September 20, 2024.	LRA

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	in the emergency diesel generator (EDG) starting air system to mitigate aging effects such as loss of material due to corrosion. b. Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. In addition, include in the Compressed Air Monitoring Program procedures the applicable provisions recommended in EPRI NP-7079, EPRI TR- 108147, and ASME OM-S/G-1998, Part 17 for air system contaminants, inspection frequency, inspection methods, and acceptance criteria for components subject to aging management review that are exposed to compressed air and components in the EDG starting air system and control air system.			
9	Enhance the Containment Inservice Inspection (CII)-IWE Program as follows: a. Revise plant procedures to require inspection of the sand cushion drain lines to monitor the internal conditions of the drain lines (e.g., for moisture, sand, blockage) and ensure there is no evidence of blockage at least once prior to the period of extended operation and once every 10 years during the period of extended operation. b. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting. c. Revise plant procedures to include the preventive actions for storage of American Society for Testing and Materials (ASTM) A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." d. [Deleted] e. [Deleted] f. Revise plant procedures to determine drywell shell thickness in the sand cushion areas before the period of extended operation and once in each 10-year interval during the period of extended operation. From the results (including prior results), develop a corrosion rate to demonstrate that the	A.1.12	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0004 dated 1/15/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation. g. Revise plant procedures to require corrective actions should moisture be detected or suspected in the inaccessible area on the exterior of the drywell shell, including: • Identify surfaces requiring augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE- 2500-1, Examination Category E-C. • Use examination methods that are in accordance with Subsection IWE-2500. • Demonstrate through use of augmented inspections performed in accordance with Subsection IWE that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.			
10	Enhance Diesel Fuel Monitoring Program as follows: a. Revise Diesel Fuel Monitoring Program procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank quarterly. In addition, revise program procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively. b. Revise the Diesel Fuel Monitoring Program procedures to include a 10-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions. The cleanings and internal inspections will be performed at least once during the 10-year period prior to the period of extended operation and at succeeding 10- year intervals. If visual inspection is not possible, perform a volumetric inspection. If evidence of degradation is observed during visual inspection, perform a volumetric examination of the affected area. The schedule for the Preventive Maintenance (PM) event to perform diesel fire pump fuel oil tank draining, flushing, and inspection will continue at its frequency at the time of the	A.1.14	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0056 dated 5/19/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	enhancement implementation, until a PM evaluation of results from fuel oil samples and tank inspections indicates that the system will be capable of continuing to perform its function during the period of extended operation with a lower frequency, not less than once per 10-year interval for cleaning and internal visual inspection consistent with NUREG-1801.			
11	Enhance External Surfaces Monitoring Program as follows: a. Revise External Surfaces Monitoring Program procedures to clarify that periodic inspections will be performed of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include structures, systems, and components (SSCs) that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2). b. Revise External Surfaces Monitoring Program procedures to inspect 100 percent of accessible components at least once per refueling cycle and to ensure required walk downs include instructions to inspect for the following related to metallic components: • Corrosion (loss of material). • Leakage from or onto external surfaces (loss of material). • Worn, flaking, or oxide-coated surfaces (loss of material). • Corrosion stains on thermal insulation (loss of material). • Protective coating degradation (cracking, flaking, and blistering). • Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking). c. Revise External Surfaces Monitoring Program procedures to include instructions for monitoring aging effects for flexible polymeric components through physical manipulations of the material, with a sample size for manipulation of at least 10 percent of the available surface area. Inspect accessible surfaces for the following: • Surface cracking, crazing, scuffing, dimensional changes (e.g., ballooning and necking).	A.1.16	Prior to September 20, 2024.	LRA DTE letter NRC-14-0051 dated 7/30/14 DTE letter NRC-15-0007 dated 1/28/15 DTE letter NRC-15-0032 dated 4/17/15 DTE letter NRC-15-0067 dated 6/18/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	• Discoloration. • Exposure of internal reinforcement for reinforced elastomers. • Hardening as evidence by loss of suppleness during manipulation where the component and material are appropriate to manipulation. • Shrinkage, loss of strength. d. Revise External Surfaces Monitoring Program procedures to specify the following for insulated components: • Periodic representative inspections will be conducted during each 10-year period. • For a representative sample of insulated indoor components exposed to condensation (because the component is operated below the dew point) and insulated outdoor components, insulation will be removed for visual inspection of the component surface. Inspections 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 will 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. • Inspection locations are based on the likelihood of corrosion under insulation (CUI). For example, CUI is more likely for 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. Subsequent inspections will 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 initial inspection: ○ No loss of material due to general, pitting or crevice corrosion, beyond that which could have been present during initial construction, and			

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	○ No evidence of cracking. 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/joints), periodic inspections under the insulation will continue as described above. • Removal of tightly adhering insulation that is impermeable to moisture is not required unless there is evidence of damage to the moisture barrier. If the moisture barrier is intact, the likelihood of CUI is low for tightly adhering insulation. Tightly adhering insulation is considered to be a separate population from the remainder of insulation installed on in-scope components. The entire population of in-scope accessible 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 acceptance criteria for the parameters observed. • Metals should not have any indications of relevant degradation. • Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color. • Rigid polymers should have no erosion, cracking, crazing or chalking. • For insulation, no discoloration, staining, or surface irregularities from moisture intrusion. f. Revise External Surfaces Monitoring Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR Part 50 Appendix B Quality Assurance Program. g. Revise External Surfaces Monitoring Program procedures to include instructions for detection of cracking of gas-filled stainless steel and aluminum components exposed to outdoor air.			

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	h. Revise External Surfaces Monitoring Program procedures to: (a) Visually inspect jacketed and nonjacketed insulation required to reduce heat transfer at a frequency consistent with NUREG-1801 Section XI.M36, as modified by LR-ISG-2012-02, to ensure that insulation degradation due to moisture intrusion has not occurred. (b) Ensure procedures include instructions to inspect for signs of water intrusion. Inspect accessible surfaces for the following signs of water intrusion: discoloration, staining, or surface irregularities.			
12	Enhance the Fatigue Monitoring Program as follows: a. Revise Fatigue Monitoring Program procedures to monitor and track critical thermal and pressure transients for components that have been identified to have a fatigue TLAA. b. Develop environmentally assisted fatigue (EAF) usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system components. This sample set will include the locations 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. Environmental correction factors will be determined using formulae consistent with those recommended in NUREG-1801, X.M1. c. 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. For components with assumed minimal cycle counts, ensure that exemption assumptions are not exceeded. d. After the EAF calculations are completed, revise the Fatigue Monitoring Program procedures to state that the program counting of the cycle limits maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. Revise Fatigue Monitoring Program procedures to allow for use of cycle-based fatigue	A.1.17	Part (b): At least 2 years prior to March 20, 2025. Remainder: Prior to September 20, 2024.	LRA DTE letter NRC-15-0005 dated 1/20/15 DTE letter NRC-15-0011 dated 2/12/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	(CBF) or stress-based fatigue (SBF) monitoring methods (including environmental effects) if a component's cumulative usage factor (CUF) value is projected to exceed 1.0 after EAF calculations are completed. e. Revise Fatigue Monitoring Program procedures so that the scope of the program includes monitoring the operating hours for the main steam bypass operation at the 30%-45% valve open position and perform trending to ensure that the operating time for the main steam bypass operation remains below the design limit during the period of extended operation. f. Revise Fatigue Monitoring Program procedures to provide for corrective actions to prevent the operating time for the main steam bypass from exceeding the analysis during the period of extended operation. Acceptable corrective actions include repair of the component, replacement of the component, or a more rigorous analysis of the component to demonstrate that the service life will not be exceeded during the period of extended operation.			
13	Enhance the Fire Protection Program as follows: a. Revise Fire Protection Program procedures to perform visual inspections to manage loss of material of the Halon and CO2 fire suppression system. b. Revise Fire Protection Program procedures to require visual inspections of in-scope: • Fire wrap and fire stop materials for loss of material, change in material properties, cracking/delamination, separation, increased hardness, shrinkage, and loss of strength. • Carbon steel penetration sleeves for loss of material. • Steel framing, roof decking, and floor decking for loss of material. • Concrete fire barriers including manways, manhole covers, handholes, and roof slabs for loss of material and cracking. • Railroad bay airlock doors for loss of material. Inspections are performed at a frequency in accordance with the NRC-approved fire protection program or at least once every refueling cycle.	A.1.18	Prior to September 20, 2024.	LRA DTE letter NRC-15-0009 dated 1/15/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
14	Enhance the Fire Water System Program as follows: a. Revise Fire Water System Program procedures to ensure sprinkler heads are tested or replaced in accordance with National Fire Protection Association (NFPA) 25 (2001 Edition), Section 5.3.1. b. Revise Fire Water System Program procedures to perform an inspection of wet fire water system piping condition at least once 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. Where multiple wet-pipe systems are in a building, every other system shall be inspected in a 5-year period. Then, in the next 5-year period, the remaining systems in that building shall be inspected. (Refer to NFPA 25 (2011 Edition), Sections 14.2.1 and 14.2.2.) The inspection method used shall be capable of detecting surface irregularities that could indicate wall loss due to corrosion, corrosion product deposition, and flow blockage due to fouling. Ensure procedures require a followup volumetric wall thickness evaluation where irregularities are detected. c. Revise Fire Water System Program procedures to: (a) ensure sprinkler heads are tested or replaced in accordance with NFPA 25 (2011 Edition) Section 5.3.1 and (b) the fire protection engineer approves the sprinkler testing laboratory. d. Revise Fire Water System Program procedures to: (a) specify that in accordance with NFPA 13.2.5.2 when there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be identified and corrected as necessary; and (b) note the time to return to static pressure after performing a main drain test.	A.1.19	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later, with the exception that the activities described in this commitment for piping segments designed to be dry but determined to be collecting water shall be conducted within 5 years prior to March 20, 2025.	LRA DTE letter NRC-14-0051 dated 7/30/14 DTE letter NRC-15-0002 dated 1/15/15 DTE letter NRC-15-0031 dated 4/10/15

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	e. Revise Fire Water System Program procedures to notify the fire protection engineer of test results and deficiencies identified or detected during testing. f. Revise Fire Water System Program procedures to ensure piping is cleaned and sprinklers are replaced if obstructions are identified during internal inspections. Sprinklers loaded with dust may be cleaned using air rather than replaced. g. Revise Fire Water System Program procedures to perform an internal inspection of wet fire water system piping conditions at least once every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of the branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinkler heads. Where multiple wet-pipe systems are in a building, every other system shall be inspected in a 5-year period. Then, in the next 5-year period, the remaining systems in that building shall be inspected. h. [Deleted] i. Revise Fire Water System Program procedures to perform at least once every 5 years either an internal inspection of the dry components downstream of the deluge valves for the hydrogen seal oil unit by removing a sprinkler toward the end of one branch line and inspecting for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinklers, or Revise Fire Water System Program procedures to perform at least once every 5 years an air or smoke test to verify there is no flow obstruction or blockage of sprinklers. j. Revise Fire Water System Program procedures to perform an inspection of the water distribution piping associated with charcoal filters for loss of material and foreign organic or inorganic material when the charcoal beds are replaced. k. Revise Fire Water System Program procedures to perform an obstruction investigation whenever any of the criteria listed in NFPA Section 14.2.1.3 or 14.3.1 are met.			

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	l. Perform a fire water system walkdown of the piping and components that are designed to be dry (e.g., downstream of deluge valves or manual isolations of dry fire water piping), but are periodically wetted, to determine if any piping sections are collecting water and are subject to both of the following augmented inspections: • In each 5-year interval, beginning 5 years prior to the period of extended operation, either (a) conduct a flow test or flush sufficient to detect potential flow blockage, or (b) 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 of the period of extended operation, inspect 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect using volumetric techniques to measure wall thickness. Measurement points will be obtained so that each potential degraded condition can be identified (e.g., general corrosion, microbiologically induced corrosion (MIC)). The 20 percent of piping that will be inspected in each 5-year interval will be in different locations than previously inspected piping. m. Revise Fire Water System Program procedures to include acceptance criteria that any indication of fouling is evaluated. n. Revise Fire Water System Program procedures to specify that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and the source and extent of condition determined, corrected, and the condition entered into the corrective action program. o. Revise Fire Water System Program procedures to replace sprinklers associated with representative tested sprinkler, if the representative test sprinkler fails to meet the test requirements. p. Revise Fire Water System Program procedures to replace any sprinkler that shows signs of corrosion. q. If the decreasing trend in fire water system flow tests is not resolved through the corrective action program prior to the period of extended operation, revise Fire Water System Program procedures to continue performing annual fire water			

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	system flow tests during the period of extended operation until such a time as trend data from fire water system flow tests indicates that the system will be capable of performing its intended function throughout the period of extended operation and, therefore, Technical Requirements Manual (TRM) frequency may be resumed. r. Revise Fire Water System Program procedures to include formal documentation of the Control Center Heating, Ventilation, and Air Conditioning (CCHVAC) makeup and recirculation fire water supply drain down inspection for indications of flow blockage.			
15	Enhance the Flow-Accelerated Corrosion Program as follows: a. Revise procedures to indicate that the Flow-Accelerated Corrosion Program also manages loss of material due to erosion mechanisms of cavitation, flashing, liquid droplet impingement, and solid particle erosion for any material in treated water or steam environments. Include in program procedures a susceptibility review based on internal operating experience, external operating experience, EPRI TR-1011231, and NUREG/CR-6031. Piping subject to erosive conditions is not excluded from inspections, even if it has been replaced with flow-accelerated corrosion-resistant material. Periodic wall thickness measurements of such piping should continue until the effectiveness of corrective actions is assured. b. Revise Flow-Accelerated Corrosion Program procedures to specify that downstream components are monitored closely for wall thinning when susceptible upstream components are replaced with resistant materials.	A.1.20	Prior to September 20, 2024.	LRA
16	Enhance the Inservice Inspection (ISI)-IWF Program as follows: a. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. b. Revise plant procedures to require structural bolting replacement and maintenance activities to include appropriate preload and proper tightening (torque or tension) as recommended in EPRI documents, ASTM standards,	A.1.22	Prior to September 20, 2024.	LRA DTE letter NRC-15-0032 dated 4/17/15 DTE letter NRC-15-0044 dated 4/27/15

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	American Institute of Steel Construction (AISC) Specifications, as applicable. c. Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." d. Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts or bolts, and cracking of concrete around the anchor bolts. e. Revise plant procedures to identify the following unacceptable conditions: • 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. f. Revise plant procedures to include the preventive action of using bolting material that has an actual measured yield strength less than 150 ksi, except in the case of like-for-like replacement of existing bolting material in the reactor pressure vessel skirt to ring girder bolted joint. g. Revise plant procedures to include assessment of the impact on the inspection sample, in terms of sample size and representativeness, if components that are part of the sample population are re-worked.			
17	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (OVHLL) Program as follows: a. Revise plant procedures to specify the monitoring of rails in the rail system for loss of material due to wear; monitor structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitor structural connections/bolting for loose or missing bolts, nuts, pins, or rivets, and any other conditions indicative of loss of bolting integrity.	A.1.23	Prior to September 20, 2024.	LRA

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	b. Revise plant procedures to specify inspection frequency requirements will be in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. c. Revise plant procedures to require that significant loss of material due to wear of rails in the rail system 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 use the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series.			
18	Implement the new Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage fouling, cracking, loss of material, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of piping and components in environments other than open-cycle cooling water, closed treated water, and fire water. Program periodic surveillances or maintenance activities will be conducted when the surfaces are accessible for visual inspection.	A.1.24	Prior to September 20, 2024.	LRA
19	Implement the new Metal Enclosed Bus Inspection Program to provide for the inspection of the internal and external portions of metal enclosed bus to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, the bus insulation and the bus insulators.	A.1.26	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA
20	Enhance Neutron-Absorbing Material Monitoring Program as follows: a. Prior to the period of extended operation, revise Neutron-Absorbing Material Monitoring Program procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every 10 years, based on the condition of the neutron-absorbing material. b. Revise Neutron-Absorbing Material Monitoring Program procedures to perform trending of coupon testing results to determine the rate of degradation. Ensure the predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.	A.1.27	Prior to September 20, 2024.	LRA
21	Implement the new Non-EQ Cable Connections Program, a one-time inspection program that consists of a representative sample of electrical	A.1.28	Prior to September 20, 2024, or the	LRA

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	connections within the scope of license renewal, which is inspected or tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during that period. Cable connections included in this program are those connections 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 that are not subject to the environmental qualification requirements of 10 CFR 50.49.		end of the last refueling outage prior to March 20, 2025, whichever is later.	
22	Implement the new Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program, a condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power (400 V to 13.8 kV) cables that have a license renewal intended function. The program calls for inaccessible or underground (e.g., in conduit, duct bank, or direct buried) power (greater than or equal to 400 V) cables exposed to significant moisture, to be tested at least once every 6 years to provide an indication of the condition of the conductor insulation, with the first tests occurring before the period of extended operation. The program will include periodic inspections for water accumulation in manholes within the scope of this program.	A.1.29	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA
23	Implement the new Non-EQ Instrumentation Circuits Test Review Program, a performance monitoring program that will manage the aging effects of applicable cables in the following systems or sub-systems. • Neutron monitoring - Intermediate range channels (IRM) - Average power range monitors (includes local power range monitors [LPRM] detector strings) • Process radiation monitoring - Control center emergency air inlet radiation monitors - Fuel pool ventilation exhaust radiation monitors - Main steam line radiation monitors The Non-EQ Instrumentation Circuits Test Review Program calls for the review of calibration results or findings of surveillance tests on electrical cables and connections used in circuits with sensitive, high-voltage, low-level current signals, such as radiation monitoring and nuclear instrumentation, to provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance. The review of calibration results or findings of surveillance tests is performed at least once every 10 years. In cases where cables are not included as part of calibration or surveillance program testing circuit, a proven cable test (such as insulation	A.1.30	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA

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	resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable system insulation condition as justified in the application) is performed. The test frequency is based on engineering evaluation and is at least once every 10 years.			
24	Implement the new Non-EQ Insulated Cables and Connections Program, a 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, moisture, and chemical contamination (i.e., bird droppings) can be maintained consistent with the current licensing basis through the period of extended operation. The program consists of accessible insulated electrical cables and connections installed in adverse localized environments to be visually inspected at least once every 10 years.	A.1.31	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0056 dated 5/19/15
25	Enhance the Oil Analysis Program as follows: a. Revise Oil Analysis Program procedures to identify components within the scope of the program. b. Revise Oil Analysis Program procedures to provide a formalized analysis technique for particulate counting. c. Revise Oil Analysis Program procedures to include the sampling and testing requirements of equipment manufacturers or industry standards.	A.1.32	Prior to September 20, 2024.	LRA
26	Implement the new One-Time Inspection Program that will consist of a one-time inspection of selected components to accomplish the following: • Verify the effectiveness of an aging management program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The aging effects evaluated are loss of material, cracking, and fouling. • Confirm the insignificance of an aging effect for situations in which additional confirmation is appropriate using inspections that verify degradation is not occurring. • Trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.	A.1.33	Inspections will be performed within the 10 years prior to March 20, 2025.	LRA
27	Implement the new One-Time Inspection – Small-Bore Piping Program that will augment ASME Code, Section XI (2001 Edition with 2003 Addenda) requirements and be applicable to small-bore ASME	A.1.34	The inspection will be performed within the 6-year	LRA

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	Code Class 1 piping and components with a nominal pipe size diameter less than 4 inches (NPS 4) and greater than or equal to 1 inch (NPS 1) in systems that have not experienced cracking of ASME Code Class 1 small-bore piping.		period prior to March 20, 2025.	
28	Enhance the Periodic Surveillance and Preventive Maintenance Program as follows: a. Revise the Periodic Surveillance and Preventive Maintenance Program procedures as necessary to incorporate the identified activities in LRA Section A.1.35. b. Revise the Periodic Surveillance and Preventive Maintenance Program procedures to state that acceptance criterion is no indication of relevant degradation and to incorporate the following: • Examples of acceptance criteria for metallic components - No excessive corrosion (loss of material) - No leakage from or onto internal surfaces (loss of material) - No excessive wear (loss of material) - No flow blockage due to fouling - No loss of piping component structural integrity • Examples of acceptance criteria for elastomeric components - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color. c. Revise Periodic Surveillance and Preventive Maintenance Program procedures to require periodic determination of wall thickness for selected piping components. d. Revise Periodic Surveillance and Preventive Maintenance Program procedures to require wall thickness measurements using ultrasonic testing (UT) or other suitable techniques at selected locations to be periodically performed to identify loss of material due to multiple corrosion mechanisms (MCM) in system piping components. The selected locations are based on pipe configuration, flow conditions, and operating history to represent a cross-section of potential MCM sites. The selected locations are periodically reviewed to validate their relevance and usefulness, and are modified accordingly. Prior	A.1.35	Prior to September 20, 2024. Initial inspection of cable spreading room dry piping will be performed within the 5 years prior to March 20, 2025.	LRA DTE letter NRC-14-0051 dated 7/30/14 DTE letter NRC-15-0002 dated 1/15/15

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	to the period of extended operation, select a method (or methods) from available technologies for inspecting internal surfaces of buried piping that provide(s) suitable indication of piping wall thickness for a representative set of buried piping locations. e. Revise Periodic Surveillance and Preventive Maintenance Program procedures to compare wall thickness measurements to nominal wall thickness or previous measurements to determine rates of corrosion degradation. Compare wall thickness measurements to code minimum wall thickness plus margin for corrosion during the refueling cycle (Tmarg) to determine acceptability of the component for continued use. Perform subsequent wall thickness measurements as needed for each selected location based on the rate of corrosion and expected time to reach Tmarg. Perform a minimum of five MCM degradation inspections per year until the rate of MCM corrosion occurrences no longer meets the criteria for recurring internal corrosion.			
29	Enhance the Protective Coating Monitoring and Maintenance Program as follows: a. Revise plant procedures to include in the program Service Level I coating applied to steel and concrete surfaces of the steel containment vessel (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors). b. Revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM D5163-08. c. Revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08. d. Revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08. e. Revise plant procedures to develop an inspection plan and specify inspection methods to be used as identified in accordance with subparagraph 10.1 of ASTM D5163-08. f. Revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties be as	A.1.36	Prior to September 20, 2024	LRA

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	defined in ASTM D7108. As a minimum, qualification of inspection personnel (protective coating surveillance personnel) who perform these inspections shall be as specified in ASTM D4537. g. Revise plant procedures to specify a protective coatings program owner (inspection coordinator and inspection results evaluator) or equivalent to nuclear coating specialist defined in ASTM D5163-08, is responsible for the overall plant coatings program and has general duties and responsibilities similar to those defined for a nuclear coating specialist in Section 5 of ASTM D7108-05. h. Revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the ECCS. i. Revise plant procedures to specify instruments and equipment needed for inspection in accordance with subparagraph 10.5 of ASTM D5163- 08. j. Revise plant procedures to specify that upon the completion of a planned refuel outage, a coatings outage summary report will be prepared of the coating work performed in Service Level I areas during the outage. The summary report prioritizes repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period. k. Revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed prior to the inspection or monitoring process. l. Revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and10.4 of ASTM D5163-08. m. Revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner.			
30	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	A.1.37	Prior to September 20, 2024.	LRA

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	material with actual measured yield strength of less than 150 kilopounds per square inch (ksi). b. Revise Reactor Head Closure Studs Program procedures to include a statement that excludes the use of molybdenum disulfide (MoS_2) on the reactor vessel closure studs and also refers to recommendations in Regulatory Guide 1.65, Rev. 1.			
31	[Deleted]			LRA DTE letter NRC-15-0020 dated 3/5/15
32	Implement the new Selective Leaching Program that will demonstrate the absence of selective leaching in a selected sample of components (i.e., 20 percent of the population with maximum of 25 components) fabricated from gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc or greater than 8 percent aluminum exposed to raw water, treated water, waste water, or soil.	A.1.40	Inspection will be performed within 5 years prior to March 20, 2025.	LRA
33	Enhance the Service Water Integrity Program as follows: a. Revise Service Water Integrity Program procedures to include inspection to determine if loss of material due to erosion is occurring in the system. b. Revise Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR Part 50 Appendix B Quality Assurance Program.	A.1.41	Prior to September 20, 2024.	LRA
34	Enhance the Structures Monitoring Program as follows: a. Revise plant procedures to add the following structures to the program. • CST and condensate return tank foundations and retaining barrier • CTG-11-1 fuel oil storage tank foundation • Independent spent fuel storage installation (ISFSI) rail transfer pad • Manholes, handholes, and duct banks • Shore barrier • Transformer and switchyard support structures and foundations	A.1.42	Prior to September 20, 2024. Testing and evaluation for possible leaching in previously identified conditions will commence in 2015.	LRA DTE letter NRC-14-0070 dated 10/24/14 DTE letter NRC-14-0082 dated 12/26/14 DTE letter NRC-15-0008 dated 1/26/15

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	b. Revise plant procedures to specify that the following in-scope structures are included in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (Section A.1.39): • General service water pump house • Residual heat removal complex • Shore barrier c. Revise plant procedures to ensure that masonry walls located in in-scope structures are in the scope of the Masonry Wall Program (Section A.1.25). d. Revise plant procedures to include a list of structural components and commodities within the scope of license renewal to be monitored in the program. e. Revise plant procedures to include periodic sampling and chemical analysis of groundwater. f. Revise plant procedures to include the following preventive actions: • Preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize the proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. • Preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, “Specification for Structural Joints Using ASTM A325 or A490 Bolts.” g. Revise plant procedures to include the following parameters to be monitored or inspected: • For concrete structures, base inspections on quantitative requirements of industry codes (i.e., American Concrete Institute (ACI) 349.3R-02), standards and guidelines (i.e., American Society of Civil Engineers (ASCE) 11) 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.			DTE letter NRC-15-0030 dated 3/19/15

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	• For chemical analysis of groundwater, monitor pH, chlorides, and sulfates. • Monitor gaps between the structural steel supports and masonry walls that could potentially affect wall qualification. h. Revise plant procedures to include the following components to be monitored for the associated parameters: • Structural bolting and anchors/fasteners (nuts and bolts) for loss of material, loose or missing nuts and/or bolts, and cracking of concrete around the anchor bolts. • Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening). i. Revise plant procedures to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments. j. Revise plant procedures to include the following for detection of aging effects: • Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R-02. • Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if performance of 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. • Submerged structures will be inspected at least once every 5 years. • If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible areas.			

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	• Sampling and chemical analysis of groundwater at least once every 5 years. The Structures Monitoring Program owner will review the results and evaluate any anomalies and perform trending of the results. • Masonry walls will be inspected at least once every 5 years, with provisions for more frequent inspections in areas where significant aging effects (e.g., missing blocks, cracking) is observed to ensure there is no loss of intended function between inspections. • Inspection of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities. • Inspections of water-control structures on an interval not to exceed 5 years. • Perform special inspections of water-control structures immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls. k. Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R-02 and information provided in industry codes, standards, and guidelines including ACI 318, American National Standards Institute (ANSI)/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria. l. 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. m. Revise Structures Monitoring Program procedures to include testing and evaluation of water/mineral deposits where in-leakage is observed in concrete elements. Testing and evaluation will determine whether leaching of calcium hydroxide and carbonation are occurring that could impact the intended function(s) of the concrete structure.			

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	n. The following testing and evaluation will be performed prior to the period of extended operation to confirm that previously identified conditions are not the result of leaching of calcium hydroxide and carbonation that could impact the intended function(s) of the concrete structure. • Available water/mineral deposit samples will be tested for mineral and iron content to assess the effect of the water in-leakage on the reinforced concrete elements involved. • The results of the testing and Structures Monitoring Program inspections will be used to determine corrective actions per the corrective action program. Possible corrective actions include, but are not limited to, more frequent inspections, sampling and analysis of the in-leakage water for mineral and iron content, testing core bore samples, and evaluation of the affected area using evaluation and acceptance criteria of ACI 349.3R-02.			

35	Enhance the Water Chemistry Control – Closed Treated Water Systems Program as follows: a. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to include the following systems. • Process sampling system sample cooler loops • CCHVAC chill water system b. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide chemical treatment, including a corrosion inhibitor for the following systems in accordance with industry guidelines and vendor recommendations. • Process sampling system sample cooler loops • CCHVAC chill water system c. 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 in accordance with EPRI 1007820, industry guidance, or vendor recommendations. d. Revise 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 once 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 identifies adverse conditions, then additional examinations, including UT, are conducted. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking. A representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components. 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.	A.1.44	Prior to September 20, 2024.	LRA DTE letter NRC-15-0030 dated 3/19/15

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
36	Implement the Coating Integrity Program as described in LRA Section B.1.45.	A.1.45	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later. Initial inspections will be performed within the 10 years prior to March 20, 2025.	DTE letter NRC-15-0021 dated 2/5/15
37	Enhance the BWR CRD Return Line Nozzle Program as follows: a. Revise BWR CRD Return Line Nozzle Program procedures as necessary to ensure that UT examinations will be used to detect applicable aging effects.	A.1.5	Prior to September 20, 2024 or the end of the last refueling outage prior to March 20, 2025, whichever is later.	DTE letter NRC-15-0056 dated 5/19/15

APPENDIX B

CHRONOLOGY

B. Chronology

This appendix lists chronologically the routine licensing correspondence between the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) and DTE Electric Company (DTE or the applicant). This appendix also lists other correspondence on the staff's review of the Fermi 2 Nuclear Power Plant (Fermi 2) license renewal application (LRA) (under Docket No. 50-341).

Table B.1-1 Appendix B: Chronology

Date	Subject
April 24, 2014	Fermi 2 License Renewal Application, NRC-14-0028 (ADAMS Accession No. ML14121A554)
June 11, 2014	Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application for DTE Electric Company, for Renewal of the Operating License for Fermi 2 (ADAMS Accession No. ML14150A416)
July 24, 2014	Plan for the Scoping and Screening Regulatory Audit Regarding the Fermi 2 License Renewal Application Review (TAC No. MF4222) (ADAMS Accession No. ML14195A221)
July 30, 2014	Fermi 2 License Renewal Application – Supplement for LR-ISG-2012-02 (TAC No. MF4222) (ADAMS Accession No. ML14213A061)
September 5, 2014	Plan for the Aging Management Program Regulatory Audit Regarding the Fermi 2 License Renewal Application Review (TAC No. MF4222) (ADAMS Accession No. ML14237A194)
September 26, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 1 (TAC No. MF4222) (ADAMS Accession No. ML14258A094)
October 20, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 2 (TAC No. MF4222) (ADAMS Accession No. ML14266A344)
October 21, 2014	Scoping and Screening Methodology Audit Report Regarding the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML14267A267)
October 24, 2014	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 1 (ADAMS Accession No. ML14301A466)
October 29, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 3 (TAC No. MF4222) (ADAMS Accession No. ML14288A680)
November 10, 2014	Summary of Telephone Conference Call Held on September 16, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Draft Request for Additional Information 2.1-1 Pertaining to the Fermi 2 Nuclear Power Plant, License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML14294A062)
November 10, 2014	Summary of Telephone Conference Call Held on September 9, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Draft Requests for Additional Information 2.4-1, 2.4-2, 2.4-3, and 3.5.2.2.2.1-1 Pertaining to the Fermi 2 Nuclear Power Plant, License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML14293A838)
November 18, 2014	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 2 (ADAMS Accession No. ML14322A930)
November 25, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 8 (TAC No. MF4222) (ADAMS Accession No. ML14322A526)
November 26, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 6 (TAC No. MF4222) (ADAMS Accession No. ML14322A203)
November 26, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 5 (TAC No. MF4222) (ADAMS Accession No. ML14322A178)
November 26, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 4 (TAC No. MF4222) (ADAMS Accession No. ML14321A752)

Date	Subject
December 1, 2014	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 3 (ADAMS Accession No. ML14335A408)
December 4, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 7 (TAC No. MF4222) (ADAMS Accession No. ML14323A880)
December 9, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 9 (TAC No. MF4222) (ADAMS Accession No. ML14329B233)
December 12, 2014	Summary of Telephone Conference Call Held on November 26, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Draft Requests for Additional Information B.1.12-1 and B.1.12-4 Pertaining to the Fermi 2 Nuclear Power Plant, License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML14335A474)
December 16, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 14 (TAC No. MF4222) (ADAMS Accession No. ML14335A188)
December 17, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 15 (TAC No. MF4222) (ADAMS Accession No. ML14342A652)
December 17, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 10 (TAC No. MF4222) (ADAMS Accession No. ML14342A868)
December 19, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 12 (TAC No. MF4222) (ADAMS Accession No. ML14342A986)
December 19, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 11 (TAC No. MF4222) (ADAMS Accession No. ML14342A938)
December 22, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 18 (TAC No. MVF4222) (ADAMS Accession No. ML14350B358)
December 23, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 16 (TAC No. MF4222) (ADAMS Accession No. ML14350B365)
December 23, 2014	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 13 (TAC No. MF4222) (ADAMS Accession No. ML14351A458)
December 26, 2014	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 8 (ADAMS Accession No. ML14363A092)
December 30, 2014	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 4, 5, and 6 (ADAMS Accession No. ML15013A276)
January 5, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 7 (ADAMS Accession No. ML15005A508)
January 14, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 17 (TAC No. MF4222) (ADAMS Accession No. ML14356A212)
January 15, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 15, NRC- 15-0009 (ADAMS Accession No. ML15016A063)
January 15, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 14 (ADAMS Accession No. ML15016A056)
January 15, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 9 (ADAMS Accession No. ML15016A022)
January 20, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 20 (TAC No. MF4222) (ADAMS Accession No. ML15002A046)
January 20, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 11, NRC-15-0006 (ADAMS Accession No. ML15021A433)

Date	Subject
January 20, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 10 (ADAMS Accession No. ML15021A393)
January 26, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 19 (TAC No. MF4222) (ADAMS Accession No. ML15015A194)
January 26, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 13 (ADAMS Accession No. ML15026A624)
January 28, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 12, NRC-15-0007 (ADAMS Accession No. ML15028A533)
January 28, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 12 (ADAMS Accession No. ML15028A534)
January 30, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 12 Questions 4.2.2-1 and 4.2.2-2 and Set 15 Question 4.2.6-1 (ADAMS Accession No. ML15030A350)
January 30, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 18 (ADAMS Accession No. ML15030A359)
February 5, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 16, NRC-15-0010 (ADAMS Accession No. ML15037A531)
February 5, 2015	Fermi 2 License Renewal Application - Response to LR-ISG-2013-01 (ADAMS Accession No. ML15037A495)
February 11, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 21 (TAC No. MF4222) (ADAMS Accession No. ML15026A399)
February 11, 2015	Aging Management Programs Audit Report Regarding the Fermi 2 Nuclear Power Plant (TAC No. MF4222) (ADAMS Accession No. ML15030A226)
February 12, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 17 (ADAMS Accession No. ML15045A007)
February 19, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 11 Question B.1.22-1, NRC-15-0029 (ADAMS Accession No. ML15050A602)
February 20, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 22 (TAC No. MF4222) (ADAMS Accession No. ML15035A130)
February 24, 2015	Schedule Revision and Project Manager Change for the Review of the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15051A348)
March 5, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 19, 20, and 21, NRC-15-0020 (ADAMS Accession No. ML15064A105)
March 11, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 24 (TAC No. MF4222) (ADAMS Accession No. ML15051A317)
March 11, 2015	Summary of Telephone Conference Call Held on February 9, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15051A509)
March 13, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 23 (TAC No. MF4222) (ADAMS Accession No. ML15051A420)
March 13, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 26 (TAC No. MF4222) (ADAMS Accession No. ML15062A336)
March 13, 2015	Request for Withholding Information from Public Disclosure (TAC No. MF4222) (ADAMS Accession No. ML15054A171)

Date	Subject
March 19, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 22 (ADAMS Accession No. ML15079A047)
March 19, 2015	Request for Withholding Information from Public Disclosure (TAC No. MF4222) (ADAMS Accession No. ML15070A161)
March 19, 2015	Summary of Telephone Conference Call Held on January 22, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 7 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15054A134)
March 19, 2015	Request for Withholding Information from Public Disclosure (TAC No. MF4222) (ADAMS Accession No. ML15072A213)
March 19, 2015	Summary of Telephone Conference Call Held on November 14, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Draft Requests for Additional Information in Sets 4, 5, and 6, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15051A507)
March 19, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 25 (TAC No. MF4222) (ADAMS Accession No. ML15072A081)
March 26, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 27 (TAC No. MF4222) (ADAMS Accession No. ML15077A108)
March 26, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 28 (TAC No. MF4222) (ADAMS Accession No. ML15078A337)
March 26, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 29 (TAC No. MF4222) (ADAMS Accession No. ML15082A046)
April 2, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 31 (TAC No. MF4222) (ADAMS Accession No. ML15085A513)
April 10, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 23, 24, and 26 (ADAMS Accession No. ML15110A342)
April 17, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 25, NRC-15-0032 (ADAMS Accession No. ML15107A408)
April 22, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 32 (TAC No. MF4222) (ADAMS Accession No. ML15099A016)
April 22, 2015	Summary of Telephone Conference Call Held on November 19, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 7 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15092A243)
April 22, 2015	Summary of Telephone Conference Call Held on February 13, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15076A468)
April 23, 2015	Request for Withholding Information from Public Disclosure (TAC No. MF4222) (ADAMS Accession No. ML15099A663)
April 27, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 27, 28, 29, 31, NRC-15-0044 (ADAMS Accession No. ML15118A557)
April 27, 2015	Summary of Telephone Conference Call Held on March 16, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 27 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15082A188)

Date	Subject
April 27, 2015	Summary of Telephone Conference Calls Held on March 6, 2015 between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15072A203)
May 13, 2015	Summary of Telephone Conference Call Held on April 7, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15098A302)
May 13, 2015	Summary of Telephone Conference Call Held on December 15, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 17 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15113A282)
May 13, 2015	Summary of Telephone Conference Call Held on December 8, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 12 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15113A198)
May 13, 2015	Summary of Telephone Conference Call Held on March 17, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 29 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15098A175)
May 13, 2015	Summary of Telephone Conference Call Held on April 10, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 33 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15117A564)
May 13, 2015	Summary of Telephone Conference Call Held on March 25, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 31 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15104A388)
May 13, 2015	Summary of Telephone Conference Call Held on March 24, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 30 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15104A504)
May 15, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 34 (TAC No. MF4222) (ADAMS Accession No. ML15126A004)
May 15, 2015	Summary of Telephone Conference Call Held on November 17, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15104A632)
May 19, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 32 (ADAMS Accession No. ML15142A461)
May 20, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 33 (TAC No. MF4222) (ADAMS Accession No. ML15139A461)
May 21, 2015	Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 35 (TAC No. MF4222) (ADAMS Accession No. ML15134A072)
May 26, 2015	Summary of Telephone Conference Call Held on March 4, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 28 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15092A224)
May 26, 2015	Summary of Telephone Conference Call Held on December 5, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15119A058)

Date	Subject
June 9, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 34 (ADAMS Accession No. ML15160A580)
June 9, 2015	Summary of Telephone Conference Call Held on December 17, 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 17 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15134A122)
June 11, 2015	Summary of Telephone Conference Call Held on May 13, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 35 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15139A519)
June 11, 2015	Summary of Telephone Conference Call Held on December 16 2014, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15133A138)
June 11, 2015	Summary of Telephone Conference Call Held on May 5, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 34 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15132A336)
June 12, 2015	Summary of Telephone Conference Calls Held on May 14, 21, and 28, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15154B318)
June 12, 2015	Request for Withholding Information from Public Disclosure (TAC No. MF4222) (ADAMS Accession No. ML15161A364)
June 18, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 35 (ADAMS Accession No. ML15170A329)
June 26, 2015	Fermi 2 License Renewal Application 2015 Annual Update (ADAMS Accession No. ML15180A327)
July 6, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 33 (ADAMS Accession No. ML15187A457)
July 6, 2015	Summary of Telephone Conference Calls Held on April 29 and May 4, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15175A039)
July 6, 2015	Summary of Telephone Conference Call Held on May 18, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15175A062)
July 6, 2015	Summary of Telephone Conference Call Held on January 14, 2015, between the U.S. Nuclear Regulatory Commission and DTE Electric Company, Concerning Requests for Additional Information, Set 19 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15175A020)
August 3, 2015	Request for Withholding Information from Public Disclosure (TAC No. MF4222) (ADAMS Accession No. ML15209A424)
August 20, 2015	Supplemental Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 33 (ADAMS Accession No. ML15232A825)
August 28, 2015	Schedule Revision for the Safety Review of the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15238B790)
September 1, 2015	Request for Additional Information for the Review of the Fermi, Unit 2, License Renewal Application – Set 37 (TAC No. MF4222) (ADAMS Accession No. ML15237A044)
September 24, 2015	Fermi 2 License Renewal Application Update for the Boraflex Monitoring Program (ADAMS Accession No. ML15268A454)

Date	Subject
September 24, 2015	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 37 (ADAMS Accession No. ML15268A490)
December 11, 2015	Summary of Telephone Conference Calls Held on August 4, and 18, 2015, Between the U.S. Nuclear Regulatory Commission and DTE Electric Company Concerning the Boraflex Monitoring Program Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML15341A261)
January 8, 2016	Summary of Telephone Conference Call Held on December 15, 2015, Between the U.S. Nuclear Regulatory Commission and DTE Electric Company Concerning the Response to Request for Additional Information 4.3.3-3 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML16005A399)
January 14, 2016	Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 38 (TAC No. MF4222) (ADAMS Accession No. ML16011A044)
January 22, 2016	Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 38 (TAC No. MF4222) (ADAMS Accession No. ML16022A220)
February 3, 2016	Schedule Revision for the Safety Review of the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML16021A257)
February 25, 2016	DTE Comments on the NRC's Safety Evaluation Report with Open Items Related to the License Renewal of Fermi 2 (TAC No. MF4222) (ADAMS Accession No. ML16057A760)
March 10, 2016	Supplemental Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 17 RAI 4.3.3-1 (TAC No. MF4222) (ADAMS Accession No. ML16074A215)
April 12, 2016	Fermi 2 License Renewal Application Response to LR-ISG-2015-01 (TAC No. MF4222) (ADAMS Accession No. ML16104A188)
May 9, 2016	Fermi 2 License Renewal Application 2016 Annual Update (TAC No. MF4222) (ADAMS Accession No. ML16131A461)
May 10, 2016	Summary of Telephone Conference Call Held on February 10 and February 25, 2016, Between the U.S. Nuclear Regulatory Commission and DTE Electric Company Concerning the Response to Request for Additional Information 4.3.3-3 Pertaining to the Fermi 2 License Renewal Application (TAC No. MF4222) (ADAMS Accession No. ML16131A066)
May 26, 2016	Fermi, Unit 2, Submittal of Revision 20 Updated Final Safety Analysis Report, 10 CFR 50.59 and 10 CFR 72.48 Evaluation Summary Reports, Commitment Management Report & Revisions to Technical Requirements Manual & Technical Specifications Bases, and a Summary of the Excessive Detail Removed from the UFSAR (ADAMS Accession No. ML16165A442)
July 6, 2016	Completion of Fermi 2 License Renewal Application Commitment Item 1

APPENDIX C

PRINCIPAL CONTRIBUTORS

C. Principal Contributors

This appendix lists the principal contributors for the development of this safety evaluation report and their areas of responsibility.

Table C.1-1 Appendix C: Principal Contributors

Name	Responsibility
Meléndez-Colón, Daneira	Project Manager
Banerjee, Gautam	Reviewer – Structural
Brittner, Donald	Reviewer – Operating Experience
Buford, Angela	Reviewer – Structural
Casto, Greg	Management Oversight
Cuadrado de Jesús, Samuel	Reviewer – Structural
Daily, John	Project Manager
Dennig, Robert	Management Oversight
Doutt, Cliff	Reviewer – Electrical
Facco, Giovanni	Reviewer – Mechanical and Materials
Fu, Bart	Reviewer – Mechanical and Materials
Gardner, William	Reviewer – Mechanical and Materials
Gavula, James	Reviewer – Mechanical and Materials
Gettys, Evelyn	Reviewer – Electrical
Green, Kimberly	Reviewer – Mechanical and Materials
Hardgrove, Matthew	Reviewer – Scoping and Screening
Hiser, Allen	Senior Technical Advisor
Holston, William	Reviewer – Mechanical and Materials
Homiack, Matthew	Reviewer – Mechanical and Materials
Hovanec, Christopher	Reviewer – Mechanical and Materials
Iqbal, Naeem	Reviewer – Scoping and Screening
Jackson, Christopher	Management Oversight
James, Lois	Project Management
Kalikian, Varoujan (Roger)	Reviewer – Mechanical and Materials
Karipineni, Nageswara	Reviewer – Scoping and Screening
Klein, Alex	Management Oversight
Krepel, Scott	Reviewer – Spent Fuel
Kulesa, Gloria	Management Oversight
Lee, Samson	Management Oversight
López Ferrer, Juan	Reviewer – Structural
Lubinski, John	Management Oversight
Lupold, Timothy	Management Oversight
Marshall, Jane	Management Oversight
Marshall, Michael	Management Oversight
McGinty, Tim	Management Oversight
Miller, Christopher	Management Oversight
Medoff, James	Reviewer – Mechanical
Min, Seung	Reviewer – Mechanical and Materials
Morey, Dennis	Management Oversight
Obodoako, Aloysius	Reviewer – Mechanical and Materials

Name	Responsibility
Otto, Ngola	Reviewer – Scoping and Screening
Pettis, Robert	Reviewer – Scoping and Screening
Plasse, Richard	Project Management
Prinaris, Andrew	Reviewer – Structural
Raval, Janak	Reviewer – Scoping & Screening
Richardson, Rebecca	Project Manager
Rogers, Bill	Reviewer – Scoping & Screening Methodology
Sadollah, Mohammad (Mo)	Reviewer – Electrical
Smith, Edward	Reviewer – Scoping & Screening
Thomas, George	Reviewer – Structural
Wise, John	Reviewer – Mechanical and Materials
Wittick, Brian	Management Oversight
Wood, Kent	Reviewer – Spent Fuel
Yoo, Mark	Reviewer – Mechanical and Materials
Zimmerman, Jacob	Management Oversight

APPENDIX D

REFERENCES

D. References

This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application (LRA) for the Fermi 2 Nuclear Power Plant (Fermi 2).

Table D.1-1 References

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