Safety Evaluation Report

Related to the License Renewal of Three Mile Island Nuclear Station, Unit 1

Docket Number 50-289

Exelon Generation Corporation, LLC

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

June 2009

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Three Mile Island Nuclear Station, Unit 1, (TMI-1) license renewal application (LRA) by the U.S. Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated January 08, 2008 AmerGen Energy Company, LLC (AmerGen or the applicant) submitted the LRA in accordance with Title 10, Part 54, of the *Code of Federal Regulations*, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” AmerGen requests renewal of the TMI-1 operating license (Facility Operating License Number DPR-50) for a period of 20 years beyond the current expiration at midnight on April 14, 2014.

TMI-1 is located approximately 10 miles southeast of Harrisburg, Pennsylvania. The staff issued the construction permit for TMI-1 on May 18, 1968, and the operating license on April 19, 1974. The plant’s nuclear steam supply system consists of a pressurized water reactor (PWR-DRYAMB) with a lowered loop. The nuclear steam supply system was supplied by Babcox & Wilcox. The balance of the plant was originally designed by Gilbert Associates and constructed by United Engineers and Constructors (UE&C). TMI-1 operates at a licensed power output of 2,568 megawatt-thermal, with a gross electrical output of approximately 852 megawatt-electric.

This SER presents the status of the staff’s review of information submitted through June 29, 2009, the cutoff date for consideration in this SER. The staff did not identify any open items that must be resolved before any final determination is reached by the staff on the LRA.

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ABBREVIATIONS

AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Document Access and Management System
ADV	atmospheric dump valve
AERM	aging effect requiring management
AFW	auxiliary feedwater
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
B&PV	Boiler and Pressure Vessel
B&W	Babcock & Wilcox
BMI	bottom mounted instrumentation
BOP	balance of plant
BTP	branch technical position
BWR	boiling water reactor
CASS	cast austenitic stainless steel
CCW	component cooling water
CCCW	closed cycle cooling water
CETNA	core exit thermocouple nozzle assembly
CFR	*Code of Federal Regulations*
CLB	current licensing basis
CO_2	carbon dioxide
CRD	control rod drive
CRDM	control rod drive mechanism
CS	containment spray
CST	condensate storage tank
Cu	copper
CUF	cumulative usage factor
CVCS	chemical and volume control
C_VUSE	Charpy upper-shelf energy
CW	circulating water
DBA	design basis accident
DBD	design basis document
DBE	design basis event
DC	direct current

ECCS	emergency core cooling system
EDG	emergency diesel generator
EFPY	effective full-power year
EHC	electro-hydraulic control
EMA	equivalent margin analysis
EN	shelter or protection
EPRI	Electric Power Research Institute
EQ	environmental qualification
ER	Environmental Report (Applicant's Environmental Report Operating License Renewal Stage)
ESF	engineered safety features
FAC	flow accelerated corrosion
F_{en}	environmental fatigue life correction factor
FERC	Federal Energy Regulatory Commission
FLB	flood barrier
FLT	filtration
FMP	Fatigue Monitoring Program
FR	*Federal Register*
FRV	feedwater regulating valve
FSAR	final safety analysis report
ft-lb	foot-pound
FW	feedwater
FWST	fire water storage tank
GALL	Generic Aging Lessons Learned Report
GDC	general design criteria or general design criterion
GEIS	Generic Environmental Impact Statement
GL	generic letter
GSI	generic safety issue
H_2	hydrogen
HELB	high-energy line break
HEPA	high efficiency particulate air
HPSI	high pressure safety injection
HVAC	heating, ventilation, and air conditioning
HX	heat exchanger
I&C	instrumentation and controls
IA	instrument air
IASCC	irradiation assisted stress corrosion cracking
ID IGA	inside diameter intergranular attack
IEEE	Institute of Electrical and Electronics Engineers
IGA	intergranular attack
IGSCC	inter-granular 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
KV or kV	kilo-volt
LBB	leak before break
LOCA	loss of coolant accident
LRA	license renewal application
MB	missile barrier
MFW	main feedwater
MIC	microbiologically-influenced corrosion
MIRVSP	master integrated reactor vessel surveillance program
MOV	motor-operated valve
MS	main steam
MSIV	main steam isolation valve
MWe	megawatts-electric
MWt	megawatts-thermal
n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
Ni	nickel
NPS	nominal pipe size
NRC	US Nuclear Regulatory Commission
NSSS	nuclear steam supply system
O_2	oxygen
OCCW	open cycle cooling water
OD IGA	outside diameter intergranular attack
ODSCC	outside-diameter stress corrosion cracking
OI	open item
OTSG	once through steam generator
P&ID	piping and instrumentation diagram
PAB	primary auxiliary building
PB	pressure boundary
PBD	program basis document
pH	potential of hydrogen
PORV	power-operated relief valve
ppm	parts per million
PSPM	periodic surveillance and preventive maintenance
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride

PW	primary water makeup
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
RAI	request for additional information
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RG	regulatory guide
RHR	residual heat removal
RM	radiation monitoring
RO	refueling outage
RPV	reactor pressure vessel
RT_{NDT}	reference temperature nil ductility transition
RT_{PTS}	reference temperature for pressurized thermal shock
RTD	resistance temperature detector
RV	reactor vessel
RVCH	reactor vessel closure head
RVLIS	reactor vessel level indication system
RW	river water
RWST	refueling water storage tank
S_A	stress allowables
SBO	station blackout
SC	structure and component
SCC	stress-corrosion cracking
SER	safety evaluation report
SFPC	spent fuel pit/pool cooling
SG	steam generator
SGBD	steam generator blowdown
SI	safety injection
SMP	structures monitoring program
SO_2	sulfur dioxide
SOC	statement of consideration
SOV	solenoid-operated valve
SPU	stretch power uprate
SR	surveillance requirement
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SSC	system, structure, and component
SSE	safe-shutdown earthquake
SSFS	safety system function sheets
SW	service water
TLAA	time-limited aging analysis
TS	technical specification(s)

UFSAR	Updated Final Safety Analysis Report
USE	upper-shelf energy
UT	ultrasonic testing
UV	ultraviolet
VCT	volume control tank
VHP	vessel head penetration
Yr	year
Zn	zinc
1/4 T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel

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SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Three Mile Island Nuclear Station, Unit 1 (TMI-1), as filed by AmerGen Energy Company, LLC (AmerGen or the applicant). By letter dated January 8, 2008, AmerGen submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the TMI-1 operating license for an additional 20 years. The NRC staff (the staff) prepared this report, which summarizes the results of its safety review of the renewal application, for compliance with the requirements of Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” The NRC license renewal project manager for the TMI-1 license renewal review is Mr. Jay Robinson. Mr. Robinson can be contacted by telephone at 301-415-2878 or by e-mail at Jay.Robinson@nrc.gov. Alternatively, written correspondence may be sent to:

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of License Renewal
Washington, D.C. 20555-0001
Attention: Jay Robinson, Mail Stop 0-11F1

By letter dated June 20, 2008, as supplemented on July 17, 2008, the applicant and Exelon Generation Company, LLC, (EGC) submitted an application to the NRC requesting approval of the transfer of the operating license for TMI-1 to the extent held by the applicant, to EGC. The staff noted that the transfer to EGC will eliminate AmerGen as owner and operator of TMI-1 and that after the transfer, EGC would be the sole licensed owner and operator of TMI-1. By letter dated December 23, 2008, the NRC issued an order approving the transfer of the operating license for TMI-1 from AmerGen to EGC, subject to two conditions.

By letter dated January 8, 2009, EGC informed the NRC that the completion of the transfer of TMI-1 from AmerGen to EGC occurred on January 8, 2009.

By letter dated January 8, 2009, the Commission issued Amendment No. 267 to Facility Operating License No. DPR-50, for TMI-1, amending the operating license at TMI-1 to reflect the new licensee due to the merger of AmerGen into its parent, EGC.

For the purposes of the SER, the use of the term “applicant” refers to AmerGen Energy Company, LLC up to and including January 7, 2009, and to Exelon Generation Company, LLC on and after January 8, 2009.

In its January 8, 2008, submission letter, the applicant requested renewal of the operating license issued under Section 104b (Operating License No. DPR-50) of the Atomic Energy Act of 1954, as amended, for TMI-1, for a period of 20 years beyond the current license expiration at midnight, April 14, 2014. TMI-1 is located approximately 10 miles southeast of Harrisburg, Pennsylvania. The staff issued the original construction permit for TMI-1 on May 18, 1968, and the operating license on April 19, 1974. The plant’s nuclear steam supply system consists of a

Babcock & Wilcox pressurized-water reactor with a lowered loop. The primary containment is of the dry ambient type. The balance of the plant was originally designed by Gilbert Associates and constructed by United Engineers and Constructors . TMI-1 operates at a licensed power output of 2,568 megawatt-thermal, with a gross electrical output of approximately 852 megawatt-electric. The updated final safety analysis report (UFSAR) contains details of the plant and the site.

The license renewal process consists of two concurrent reviews: a technical review of safety issues and an environmental review. The NRC regulations in 10 CFR Parts 54 and 51, respectively, set forth requirements for these reviews. The safety review for the TMI-1 license renewal is based on the applicant's LRA and on the responses to the staff's requests for additional information (RAIs). The applicant supplemented and clarified its responses to the LRA and RAIs in audits, meetings, and docketed correspondence. Unless otherwise noted, the staff reviewed and considered information submitted through February 20, 2009. The staff reviewed the information received after that date on a case-by-case basis, depending on the stage of the safety review and the volume and complexity of the information.

The public may view the LRA and all pertinent information and materials, including the UFSAR, at the following locations: The NRC Public Document Room, One White Flint North, 11555 Rockville Pike (First Floor), Rockville, MD 20852-2738 (301-415-4737/800-397-4209); the Middletown Public Library, 20 North Catherine Street, Middletown, PA 17057; the Penn State Harrisburg Library, 351 Olmsted Drive, Middletown, PA 17057; and the Londonderry Township Municipal Building, 783 South Geyers Church Road, Middletown, PA 17057. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC website .

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in the evaluation of 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 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated July 2001.

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

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

In accordance with 10 CFR Part 51, the staff prepared a draft plant-specific supplement to the Generic Environmental Impact Statement (GEIS). This supplement discusses the environmental considerations related to license renewal for TMI-1. The staff issued draft Supplement 37 to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Three Mile Island Nuclear Station, Unit 1, Draft Report for Comment," in December of 2008.

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. These licenses can be renewed for up to 20 additional years. The original 40-year license term was selected on the basis of economic and antitrust considerations, rather than on technical limitations; however, some individual plant and equipment designs may have been engineered based on 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 staff to establish a comprehensive program plan for nuclear plant aging research. On the basis of the results of that research, a technical review group concluded that many aging phenomena are readily manageable and pose no technical issues that would preclude 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 the license renewal rule in 10 CFR Part 54 (the Rule). The staff participated in an industry-sponsored demonstration program to apply the Rule to a pilot plant and to gain experience necessary to develop implementation guidance. To establish a scope of review for license renewal, the Rule defined age-related degradation unique to license renewal; however, during the demonstration program, the staff found that many aging mechanisms occur to plant systems and components with effects managed during the initial license period. In addition, the staff found that the scope of the review did not allow sufficient credit for existing programs, particularly the implementation of the Maintenance Rule, which also manages plant-aging phenomena.

As a result, the staff amended the Rule in 1995. As amended, 10 CFR Part 54 established a regulatory process that is simpler, more stable, and more predictable than the previous Rule. In particular, as amended, 10 CFR Part 54 focused on management of adverse aging effects rather than on identification of age-related degradation unique to license renewal. The staff initiated 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 revised Rule clarified and simplified the integrated plant assessment process for consistency with the revised focus on passive, long-lived structures and components (SCs).

In parallel with these efforts, in a separate rulemaking effort, the staff amended 10 CFR Part 51 to focus the scope of the review of environmental impacts of license renewal and fulfill the staff's responsibilities under the National Environmental Policy Act of 1969 (NEPA).

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 exception of the detrimental aging effects on the function 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 defines the scope of license renewal as including SSCs (1) that are safety-related, (2) whose failure could affect safety-related functions, and (3) that are relied on to demonstrate compliance with NRC regulations for fire protection, environmental qualification , pressurized thermal shock , anticipated transient without scram , and station blackout .

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

Pursuant to 10 CFR 54.21(d), each LRA is required to include an UFSAR Supplement that must have a summary description of the applicant's programs and activities for managing aging effects and the 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 are made about the length of time the plant can operate. These assumptions are incorporated into design calculations for several plant SSCs. In accordance with 10 CFR 54.21(c)(1), the applicant must 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 effects of aging on these SSCs can be adequately managed for the period of extended operation.

In 2001, the staff developed and issued 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 3, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," issued in March 2001 by the NEI. NEI 95-10 details an acceptable method of implementing the Rule. The staff also used the SRP-LR to review this application.

In its LRA, the applicant stated that it fully utilized the process defined in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," issued in July 2001 and subsequently revised in September 2005. The GALL Report provides a summary of staff-approved aging management programs (AMPs) for the aging of many SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources to review an applicant's LRA can be greatly reduced, thereby 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 SCs used throughout the industry. The report is also a reference for both applicants and staff reviewers to quickly identify AMPs and activities that can provide adequate aging management during the period of extended operation.

1.2.2 Environmental Review

In December 1996, the staff revised the environmental protection regulations to facilitate the environmental review for license renewal. The staff prepared a "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (NUREG-1437, Revision 1) to document its evaluation of the possible environmental impacts associated with renewing licenses of nuclear power plants. For certain types of environmental impacts, the GEIS establishes generic findings applicable to all nuclear power plants. These generic findings are codified in Appendix B to Subpart A of 10 CFR Part 51. Pursuant to 10 CFR 51.53(c)(3)(i), an applicant for license renewal may incorporate these generic findings in its environmental report. In accordance with 10 CFR 51.53(c)(3)(ii), an environmental report must also include analyses of environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In accordance with NEPA and the requirements of 10 CFR Part 51, the staff performed a plant-specific review of the environmental impacts of license renewal, including whether the GEIS had not considered new and significant information. As part of its scoping process, the staff held a public meeting on May 1, 2008 in Middletown, Pennsylvania, to identify plant-specific environmental issues. The staff's draft plant-specific GEIS Supplement 37, issued in December of 2008, documents the results of the environmental review and includes a preliminary recommendation for license renewal action. Another public meeting was held on February 24, 2009 in Middletown, Pennsylvania, to discuss the draft plant-specific GEIS Supplement 37. After considering comments on the draft, the staff prepared and published on June 25, 2009 a final plant-specific supplement to the GEIS separately from this report (ADAMs Accession No. ML091751063).

1.3 <u>Principal Review Matters</u>

Part 54 of 10 CFR describes the requirements for renewing operating licenses for nuclear power plants. The staff performed its technical review of the LRA in accordance with NRC guidance and 10 CFR Part 54 requirements. Section 54.29 of 10 CFR sets forth the standards for renewing a license. This SER describes the results of the staff's safety review.

Under 10 CFR 54.19(a), the NRC requires a license renewal applicant to submit general information. The applicant provided this general information in LRA Section 1, which it submitted, by letter dated January 8, 2008. The staff reviewed LRA Section 1 and found that the applicant had submitted the information required by 10 CFR 54.19(a).

Under 10 CFR 54.19(b), the staff requires that each 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." The applicant stated the following in LRA Section 1.1.10 on this issue:

> 10 CFR 54.19(b) requires that "each application must include conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the

> expiration term of the proposed renewed license." The current indemnity agreement (No. B-64) for TMI-1 states in Article VII that the agreement shall terminate at the time of expiration of that license specified in Item 3 of the Attachment to the agreement, which is the last to expire; provided that, except as may otherwise be provided in applicable regulations or orders of the Commission, the term of this agreement shall not terminate until all the radioactive material has been removed from the location and transportation of the radioactive material from the location has ended as defined in subparagraph 5(b), Article I. Item 3 of the Attachment to the indemnity agreement includes license number, DPR-50. Applicant requests that any necessary conforming changes be made to Article VII and Item 3 of the Attachment, and any other sections of the indemnity agreement as appropriate to ensure that the indemnity agreement continues to apply during both the terms of the current license and the terms of the renewed license. Applicant understands that no changes may be necessary for this purpose if the current license number is retained.

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.

Under 10 CFR 54.21, the staff requires that each LRA contain:

(a) an IPA
(b) a description of any CLB changes during the staff's review of the LRA
(c) an evaluation of TLAAs
(d) an 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).

Under 10 CFR 54.21(b), the staff 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 of the facility that materially affect the contents of the LRA, including the UFSAR Supplement. The applicant submitted an update to the LRA by letter dated January 9, 2009, summarizing the CLB changes that have occurred during the staff's review of the LRA which satisfies the requirements of 10 CFR 54.21(b) .

Under 10 CFR 54.22, the staff requires that an applicant's LRA include changes or additions to the technical specifications necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated the following:

> As part of the TMI-1 aging management review, AmerGen identified and committed to the replacement of both Once Through Steam Generators (OTSGs) prior to the period of extended operation. In association with this replacement, a separate Technical Specification Change Request will be submitted. No Technical Specification changes or additions were identified as necessary to manage the effects of aging during the period of extended operation and as such no Technical Specification changes or additions are included with this License Renewal Application.

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

As required by 10 CFR 54.25, the ACRS will issue a report to document its evaluation of the staff's LRA review and associated SER. SER Section 5 will incorporate the ACRS report once it is issued. SER Section 6 will document the findings required by 10 CFR 54.29.

The final plant-specific GEIS supplement will document the staff's evaluation of the environmental information required by 10 CFR 54.23 and will specify the considerations for renewing the TMI-1 license. The staff will prepare the supplement separately from the SER.

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 the GALL Report.

Table 1.4-1 shows the current and proposed ISGs, as well as the SER sections in which they are addressed.

Table 1.4-1 Current and Proposed Interim Staff Guidance

ISG Issue (Approved ISG No.)	Purpose	SER Section
LR-ISG-19B	Cracking of nickel-alloy components in the reactor coolant pressure boundary This LR-ISG is under development. The Nuclear Energy Institute (NEI) and the Electric Power Research Institute Materials Reliability Program (EPRI-MRP) are developing an augmented inspection program for GALL AMP XI.M11-B, "Nickel-Alloy Base-Metal Components and Welds in the Reactor Coolant Pressure Boundary." This AMP will not be completed until after the staff approves an augmented inspection program for nickel-alloy base metal components and welds as proposed by the ERPI-MRP.	3.0.3.3.1
LR-ISG-2006-01	Corrosion of the Mark I steel containment drywell shell	Not Applicable to TMI-1

1.5 Summary of Open Items

After its review of the LRA, including additional information submitted through June 29, 2009, the staff has identified no open items. An item would be considered open if the applicant had not presented a sufficient basis for issue resolution.

1.6 Summary of Confirmatory Items

Following the staff's review of the LRA, including additional information and clarifications submitted through June 29, 2009, the staff closed previous confirmatory item (CI) 4.3.2-1 identified in the "Safety Evaluation Report With Open Items Related to the License Renewal of Three Mile Island Nuclear Station Unit 1" (ADAMS Accession No. ML090710604). The staff has identified no other confirmatory items. An item would be considered confirmatory if the staff and the applicant reached a satisfactory resolution, but the resolution had not yet been formally submitted to the staff.

In closed CI 4.3.2-1 the staff noted that the maximum Fen values for carbon steels and low alloy steels (1.74, 2.455, respectively) are based, in part, on an assumed dissolved oxygen (DO) concentration level of 0.05 ppm. For stainless steels, the maximum Fen (15.35) is based, in part, on an assumed DO level of < 0.05 ppm. The staff questioned whether the assumed value of 0.05 ppm DO was a "bounding assumption." In a letter dated April 29, 2009 (ADAMS Accession No. ML091210104) the applicant provided additional information confirming the DO level's historically maintained at TMI-1 and also confirming the surveillance procedure for water chemistry sampling includes an administrative limit for DO of <0.05 ppm. Based on its review, the staff determined that this additional information was sufficient to close CI 4.3.2-1. See SER Section 4.3.2.2 for additional information.

1.7 Summary of Proposed License Conditions

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

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

The second license condition requires the applicant to complete the commitments in the UFSAR supplement, and notify the NRC in writing when implementation of those activities required prior to the period of extended operations are complete and can be verified by NRC inspection.

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 for each license renewal application (LRA) an integrated plant assessment (IPA) listing those structures and components (SCs) subject to an aging management review (AMR) for all of the structures, systems, and components (SSCs) within the scope of license renewal.

LRA Section 2.1, “Scoping and Screening Methodology,” describes the methodology for identifying SSCs at the Three Mile Island Nuclear Station, Unit 1, (TMI-1) within the scope of license renewal and SCs subject to an AMR. The staff reviewed the scoping and screening methodology of AmerGen Energy Company, LLC (AmerGen or the applicant) to determine whether it meets the scoping requirements of 10 CFR 54.4(a) and the screening requirements of 10 CFR 54.21.

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

2.1.2 Summary of Technical Information in the Application

LRA Sections 2 and 3 state the technical information required by 10 CFR 54.4, “Scope,” and 10 CFR 54.21(a). This safety evaluation report (SER) with open items contains sections entitled “Summary of Information from the Application,” which provide information taken directly from the LRA.

LRA Section 2.1, describes the process used to identify the SSCs that meet the license renewal scoping criteria under 10 CFR 54.4(a), and the process used to identify the SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1). Additionally, LRA Section 2.2 “Plant Level Scoping Results,” Section 2.3 “Scoping and Screening Results: Mechanical,” Section 2.4 “Scoping and Screening Results: Structural,” and Section 2.5 “Scoping and Screening Results: Electrical Systems/Commodity Groups,” provided the results of the process used to identify the SCs that are subject to an AMR. LRA Section 3.0, “Aging Management Review Results,” contains the following information: Section 3.1 “Aging Management of Reactor Vessel, Internals and Reactor Coolant System,” Section 3.2 “Aging Management of Engineered Safety Features Systems,” Section 3.3 “Aging Management of Auxiliary Systems,” Section 3.4 “Aging Management of Steam and Power Conversion System,” Section 3.5 “Aging Management of Containment, Structures and Component Supports,” and Section 3.6 “Aging Management of

Electrical Commodity Groups." LRA Section 4 "Time-Limited Aging Analyses (TLAA)," contains the applicant's identification and evaluation of TLAAs.

2.1.3 Scoping and Screening Program Review

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

- 10 CFR 54.4(a), as it relates to the identification of plant 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)(1) and (a)(2), as they relate to the methods utilized by the applicant to identify plant SCs subject to an AMR

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

- Section 2.1.5, to ensure that the applicant described a process for identifying the SSCs within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)
- Section 2.1.6, to ensure that the applicant described a process for determining the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1) and (a)(2)

In addition, the staff conducted a scoping and screening methodology audit at TMI-1 during the week of May 19–22, 2008. The audit focused on ensuring that the applicant had developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the LRA and the requirements of the Rule. The staff reviewed the implementation of project level guidelines and topical reports describing the applicant's scoping and screening methodology. The staff conducted detailed discussions with the applicant on the implementation and control of the license renewal program and reviewed the administrative control documentation used by the applicant during the scoping and screening process, the quality practices used by the applicant to develop the LRA, and the training and qualification program of the LRA development team. The staff evaluated the quality attributes of the applicant's aging management program (AMP) activities described in Appendix A, "Final Safety Analysis Report Supplement," and Appendix B, "Aging Management Programs," of the LRA. The staff also reviewed the training and qualifications of the LRA development team. On a sampling basis, the staff performed a review of the main steam system, the decay heat removal system, the turbine building, and the intermediate building, including a review of the scoping and screening results reports and the supporting design documentation used to develop the reports. This review was performed to ensure that the applicant had appropriately implemented the methodology outlined in the administrative controls and to verify that the results were consistent with the current licensing basis (CLB) documentation.

2.1.3.1 Implementing Procedures and Documentation Sources Used for Scoping and Screening

The staff reviewed the applicant's scoping and screening implementing procedures as documented in the Scoping and Screening Methodology Audit report, dated December 3, 2008, (ADAMS Accession No. ML083240245) to verify that the process used to identify SCs subject to an AMR was consistent with the SRP-LR. Additionally, the staff reviewed the scope of CLB documentation sources and the process used by the applicant to ensure that the applicant's commitments, as documented in the CLB and relative to the requirements of 10 CFR 54.4 and 10 CFR 54.21, were appropriately considered and that the applicant adequately implemented its procedural guidance during the scoping and screening process.

2.1.3.1.1 Summary of Technical Information in the Application

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

- Updated Final Safety Analysis Report (UFSAR)
- Preliminary safety analysis report
- Fire hazards analysis report
- Environmental qualification master list
- Design basis documents
- Maintenance rule information
- Controlled plant component database
- Plant drawings
- Docketed correspondence

The applicant stated that it used this information to identify the functions performed by plant systems and structures. It then compared these functions to the scoping criteria in 10 CFR 54.4(a)(1)-(3) to determine if the associated plant system or structure performed a license renewal intended function. It also used these sources to develop the list of SCs subject to an AMR.

2.1.3.1.2 Staff Evaluation

Scoping and Screening Implementation Procedures. The staff reviewed the applicant's scoping and screening methodology implementation procedures, including license renewal guidelines, documents, reports, and AMR reports, to ensure the guidance was consistent with the requirements of the Rule, the SRP-LR, and NEI 95-10. The staff finds the overall process used to implement the 10 CFR Part 54 requirements described in the implementing documents and AMRs is consistent with the Rule, the SRP-LR, and industry guidance. The applicant's implementing documents contain guidance for determining plant SSCs within the scope of the Rule, and for determining which SCs within the scope of license renewal are subject to an AMR. During the review of the implementing documents, the staff focused on the consistency of the detailed procedural guidance with information in the LRA, including the implementation of the NRC the staff position concerning what SSCs meet the 10 CFR 54.4(a)(2) criterion, which is documented in the SRP-LR.

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

<u>Sources of Current Licensing Basis Information</u>. During the audit, the staff reviewed the scope and depth of the applicant's CLB review to verify that the methodology is sufficiently comprehensive to identify SSCs within the scope of license renewal, as well as SCs requiring an AMR. Pursuant to 10 CFR 54.3(a), the CLB is the set of 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 certain NRC regulations, orders, license conditions, exemptions, Technical Specifications, design-basis information (documented in the most recent Updated Final Safety Analysis Report [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.

During the audit, the staff reviewed pertinent information sources used by the applicant including the UFSAR, license renewal boundary diagrams, design basis documents, and maintenance rule information. In addition, the applicant identified additional potential sources of plant information pertinent to the scoping and screening process, including preliminary safety analysis report, fire hazards analysis report, environmental qualification master list, controlled plant component database, plant drawings, and docketed correspondence. The staff confirmed that the applicant's detailed license renewal program guidelines specified the use of the CLB source information in developing scoping evaluations.

The TMI-1 component record list (CRL) and the maintenance rule information were the applicant's primary repository for component safety classification information. During the audit, the staff reviewed the applicant's administrative controls for the CRL. These controls are described, and implementation is governed, by plant administrative procedures. Based on a review of the administrative controls and a sample of the system classification information contained in applicable plant documentation, the staff concludes that the applicant has established adequate measures to control the integrity and reliability of its safety classification data, and therefore, the staff concludes that the information sources used by the applicant during the scoping and screening process have provided a sufficiently controlled source of system and component data to support scoping and screening evaluations.

During the staff's review of the applicant's CLB evaluation process, the applicant explained the incorporation of updates to the CLB and the process used to ensure those updates are adequately incorporated into the license renewal process. The staff determined that Section 2.1 of the LRA provided a description of the CLB and related documents used during the scoping and screening process that is consistent with the guidance contained in the SRP-LR.
In addition, the staff reviewed the implementing procedures and results reports used to support identification of SSCs relied on to demonstrate compliance with the safety-related criteria,

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

2.1.3.1.3 Conclusion

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

2.1.3.2 Quality Controls Applied to LRA Development

2.1.3.2.1 Staff Evaluation

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

- The scoping and screening methodology was governed by written procedures and guidelines.
- The LRA was examined by the applicant's team in a structured self assessment.
- The LRA was examined by internal assessment teams, including a challenge board, plant oversight review committee, nuclear oversight team, and a nuclear safety review board. Each of these teams included different levels of plant and organizational management.
- The LRA was examined by external assessment teams, including peer reviews. Additional benchmarking was also done of recent license renewal applicants.
- Comments received through the assessment process were addressed and managed by peer and management review.

The audit team reviewed the applicant's focused area self assessment (FASA) and a sample comment resolution table and determined that the applicant's comment resolution process is consistent and adequate.

2.1.3.2.2 Conclusion

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

2.1.3.3 Training

2.1.3.3.1 Staff Evaluation

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

- Training was required for the license renewal project personnel and followed documented, written guidance.
- Initial qualification was completed before the project started and included the review of the license renewal process, license renewal project guidance, and relevant industry documents such as 10 CFR Part 50 regulations; NEI 95-10; Regulatory Guide 1.188; the SRP-LR; and NUREG-1801 Revision 1, "Generic Aging Lessons Learned Report."
- Classroom training featured classroom training sessions on topics such as site documentation overview, systems and structures overview, system specific training, and database training.
- Phase training included the review of processes and procedures for the preparation of the basis documents.
- Biweekly training featured meetings where discussions were held to educate the applicant's personnel on current and emerging issues pertaining to the preparation and handling of the LRA.

2.1.3.3.2 Conclusion

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

2.1.3.4 Scoping and Screening Program Review Conclusion

On the basis of its review of information provided in Section 2.1 of the LRA, and its review of the applicant's detailed scoping and screening implementing procedures, QA controls applied, the applicant's training process, the results from the scoping and screening audit, and discussions with the applicant's license renewal personnel, 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 scope SSCs pursuant to the requirements of the 10 CFR 54.4(a) scoping criteria. The applicant described the scoping process for the plant in terms of systems and structures. Specifically, the applicant developed a list of plant systems and structures, identified their intended functions, and determined which functions meet one or more of the three criteria of 10 CFR 54.4(a). The scoping evaluations were documented in a System and Structure Scoping Report. If any portion of a system or structure met the scoping criteria of 10 CFR 54.4, the system or structure was included within the scope of license renewal. Mechanical systems and structures were then further evaluated to determine those mechanical and structural components that perform or support the identified intended functions. The in-scope boundaries of mechanical systems and structures were developed and depicted on license renewal boundary drawings. Electrical and I&C components contained within in-scope electrical or mechanical systems were included within the scope of license renewal regardless of function.

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

2.1.4.1.1 Summary of Technical Information in the Application

LRA Section 2.1.5.1, "Safety-Related—10 CFR 54.4(a)(1)," describes the scoping methodology as it relates to the safety-related criterion in accordance with 10 CFR 54.4(a)(1). The safety-related systems and structures were identified in the CRL.

The applicant stated that the safety-related classifications in the CRL were established using a controlled procedure and that the classification criteria differences relative to 10 CFR 54.4(a)(1) were evaluated in a license renewal basis document and accounted for during the license renewal scoping process. Safety-related classifications for systems and structures were based on system and structure descriptions and analyses in the UFSAR or design basis documents. Systems and structures identified as safety-related in the UFSAR, in design basis documents, or in the CRL were included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The applicant confirmed that it considered all plant conditions, including conditions of normal operation, anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed, for license renewal scoping under the 10 CFR 54.4(a)(1) criteria.

2.1.4.1.2 Staff Evaluation

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

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

> The set of DBEs as defined in the Rule is not limited to Chapter 15 (or equivalent) of the UFSAR. Examples of DBEs that may not be described in this chapter include external events, such as floods, storms, earthquakes, tornadoes, or hurricanes, and internal events,

such as a high energy line break. Information regarding DBEs as defined in 10 CFR 50.49(b)(1) may be found in any chapter of the facility UFSAR, the Commission's regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify SSCs relied upon to remain functional during and following DBEs (as defined in 10 CFR 50.49(b)(1)) to ensure the functions described in 10 CFR 54.4(a)(1).

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

The applicant performed scoping of SSCs for the 10 CFR 54.4(a)(1) criterion in accordance with the license renewal implementing documents which provide guidance for the preparation, review, verification, and approval of the scoping evaluations to ensure the adequacy of the results of the scoping process. The staff reviewed the implementing documents 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 those written instructions. In addition, the staff discussed the methodology and results with the applicant's personnel who were responsible for these evaluations.

The staff reviewed the applicant's evaluation of the Rule and CLB definitions pertaining to 10 CFR 54.4(a)(1) and determined that TMI-1s CLB definition of "safety-related" referred to 10 CFR 50.67 (for loss-of-coolant accident (LOCA) and fuel handling accident (FHA) analyses) and to 10 CFR 100, for all other accidents. The applicant stated that the definition did not contain references to 10 CFR 50.34 as specified in the Rule since 10 CRF 50.34(a)(1) is only applicable to facilities seeking a construction permit. The applicant's definition of "safety-related" and exceptions to the definition in the Rule are documented in LRA Section 2.1.3.2. Based on its review, the staff verified that 10 CFR 50.34(a)(1) is in fact, not applicable, since it concerns applicants for a construction permit. The staff determined that 10 CFR 50.67(b)(2), which concerns the use of an alternate source term in the dose analysis, is applicable as described in the loss of coolant and fuel handling accident analyses, and was adequately addressed during the scoping process.

The staff reviewed a sample of the license renewal scoping results for the main steam system, decay heat removal system, the turbine building, and the intermediate building to provide additional assurance that the applicant adequately implemented its scoping methodology with respect to 10 CFR 54.4(a)(1). The staff confirmed that the applicant developed the scoping results for each of the sampled systems consistently with the methodology, identified the SSCs credited for performing intended functions, and adequately described the basis for the results as well as the intended functions. The staff also confirmed that the applicant had identified and used pertinent engineering and licensing information to identify the SSCs required to be in scope in accordance with the 10 CFR 54.4(a)(1) criteria.

2.1.4.1.3 Conclusion

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

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

2.1.4.2.1 Summary of Technical Information in the Application

LRA Section 2.1.5.2, "Nonsafety-Related Affecting Safety-Related—10 CFR 54.4(a)(2)," describes the applicant's scoping methodology as it relates to the nonsafety-related criteria in 10 CFR 54.4(a)(2). The applicant's 10 CFR 54.4(a)(2) scoping methodology was based on guidance provided in Appendix F of NEI 95-10, Revision 6. By considering functional failures and physical failures, the applicant evaluated the impacts of nonsafety-related SSCs that meet 10 CFR 54.4(a)(2) criteria.

<u>Functional Support for Safety-Related SSC 10 CFR 54.4(a)(1) Functions</u>. LRA Section 2.1.5.2 states that nonsafety-related SSCs required to perform a function in support of safety-related components are included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The staff finds that for the nonsafety-related systems and structures required to remain functional to support a safety function, the systems and structures were included within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(2).

<u>Connected to and Provide Structural Support for Safety-Related SSCs</u>. LRA Section 2.1.5.2 states that for a nonsafety-related piping systems connected to a safety-related piping system, the nonsafety-related system was assumed to provide structural support to the safety-related system, unless otherwise confirmed by a review of the installation details. The applicant stated that the entire nonsafety-related system was included in scope for 10 CFR 54.4(a)(2), up to one of the following:

(1) A seismic anchor or at least two supports in each of three orthogonal directions.

(2) A base-mounted component that is a rugged component and is designed not to impose loads on connecting piping.

(3) A flexible connection that is considered a pipe stress analysis model end point when the flexible connection effectively decouples the piping system.

(4) A free end of nonsafety-related piping.

(5) A point where buried piping exits the ground.

(6) For nonsafety-related piping runs that are connected at both ends to safety-related piping the entire run of nonsafety-related piping was included in scope.

The applicant stated that the failure in the nonsafety-related piping beyond the above anchor or equivalent anchor locations would not impact structural support of the safety-related piping.

Potential for Spatial Interactions with Safety-Related SSCs. LRA Section 2.1.5.2 states that nonsafety-related systems that are not connected to safety-related piping or components, or are beyond the first anchor, are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) if there is a potential for spatial interactions with safety-related equipment such that the failure of the nonsafety-related SSC could prevent the safety related SSC from performing its intended function. The staff notes that spatial failures are defined as failures of nonsafety-related SSCs that are connected to or located in the vicinity of safety-related SSCs, creating the potential for interaction between the SSCs from physical impact, pipe whip, jet impingement, a harsh environment resulting from a piping rupture, or damage from leakage or spray that could impede or prevent the accomplishment of the safety-related functions of a safety-related SSC. In addition, overhead handling systems and mitigative features, such as pipe whip restraints, jet impingement shields, spray and drip shields, seismic supports, and flood barriers, are included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The applicant used the preventive option described in NEI 95-10, Appendix F, to determine the scope of license renewal with respect to the protection of safety-related SSCs from spatial interactions. This scoping process, referred to as the “spaces” approach, involves an evaluation based on equipment location and the related SSCs and whether or not fluid-filled system components are located in the same space as safety-related equipment. A “space,” for the purposes of the review, was defined as a structure containing active or passive safety-related SSCs.

2.1.4.2.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(2), the applicant must consider all nonsafety-related SSCs, whose failure could prevent the satisfactory accomplishment of safety-related functions of SSCs relied on to remain functional during and following a DBE to ensure: (i) the integrity of the reactor coolant pressure boundary; (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition; or (iii) the capability to prevent or mitigate the consequences of accidents 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.

NRC Regulatory Guide 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses,” Revision 1 (Reg. Guide 1.188), endorses the use of NEI 95-10, Revision 6. NEI 95-10 describes the staff’s position on 10 CFR 54.4(a)(2) scoping criteria, including nonsafety-related SSCs typically identified in the CLB; consideration of missiles, cranes, flooding and high energy line breaks; nonsafety-related SSCs connected to safety-related SSCs; nonsafety-related SSCs in proximity to safety-related SSCs, and mitigative and preventative options related to nonsafety-related and safety-related SSCs interactions.

In addition, the staff’s position (as discussed in NEI 95-10, Revision 6) is that the evaluation to determine which nonsafety-related SSCs are within scope should not consider hypothetical failures, but should, based on engineering judgment and operating experience, consider the likelihood of system failure during the extended period of operation. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports; plant-specific condition reports; industry reports, such as safety operational event reports; and engineering evaluations. The staff reviewed LRA Section 2.1.5.2 in which the applicant described the scoping methodology for nonsafety-related SSCs pursuant to 10 CFR 54.4(a)(2). In addition, the staff reviewed the applicant’s basis document and results report, which documents the guidance and corresponding results of the applicant's scoping review pursuant to 10 CFR 54.4(a)(2). The applicant stated that it performed this review in accordance with the guidance contained in NEI 95-10, Revision 6, Appendix F.

Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC. The staff determined that nonsafety-related SSCs required to remain functional to support a safety-related function were included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant's scoping report discussed the evaluating criteria pursuant to 10 CFR 54.4(a)(2). The staff finds that the applicant implemented an acceptable method for scoping of the nonsafety-related systems that perform functions that support safety-related functions as required by 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs. The applicant reviewed the safety-related to nonsafety-related interfaces for each mechanical system to identify the nonsafety-related components located between the safety-related to nonsafety-related interface and license renewal structural boundary. The applicant included the entire nonsafety-related system within the license renewal structural boundary within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

Based on its review, the staff determined that in order to identify the nonsafety-related SSCs connected to safety-related SSCs and required to be structurally sound to maintain the integrity of the safety-related SSCs, the applicant 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 NEI 95-10, Appendix F (base-mounted component, flexible connection, or inclusion of the entire piping run).
- Approved design engineering evaluation and acceptance of an endpoint for scoping that provides documentation that piping beyond the scoping endpoint is not required for support of the safety-related piping components.

During the audit, the staff reviewed the applicant's 10 CFR 54.4(a)(2) scoping methodology for attached piping, and the application of the methodology to an abandoned-in-place system (i.e., hydrogen purge system). The staff reviewed the scoping results for the abandoned hydrogen purge system and was not able to determine whether the applicant had applied the methods described in LRA Section 2.1.5.2 to determine the portion of the nonsafety-related piping, attached to safety-related SSCs, to be included within the scope of license renewal. In RAI 2.1.5.2-1, dated August 22, 2008, the staff requested the applicant provide additional information describing the methods used and the basis for conclusions, in determining the portion of nonsafety-related abandoned hydrogen purge discharge system piping, attached to safety-related SSCs, to be included within the scope of license renewal.

In its response to the RAI dated September 8, 2008, the applicant stated that it had determined the boundary for the hydrogen purge systems had been incorrectly identified on the license renewal drawing. The applicant modified the boundary to include the appropriate portion of the nonsafety-related piping, attached to safety-related piping, required for structural support.

Based on its review, the staff finds the applicant's response to RAI 2.1.5.2-1 acceptable because the applicant had reviewed the implementation of its methodology used to identify portions of abandoned, nonsafety-related SSCs attached to safety-related SSCs to be included within the scope of license renewal and had identified and included the required portions of the nonsafety-related SSCs. The staff's concern described in RAI 2.1.5.2-1 is resolved.

During the audit, the staff noted the applicant had not clearly defined scoping endpoints for three attached piping segments in the make-up and purification system (license renewal drawing: LR-302-661, Revision 0 for piping connected to valves MU-V111, MU-V27, and MU-V41) because the piping was inaccessible at power. In RAI 2.1.5.2-2, the staff requested that the applicant provide additional information describing the methods used, and the basis for conclusions, in determining the portion of nonsafety-related inaccessible piping attached to safety-related SSCs, to be included within the scope of license renewal.

In its response to the RAI, dated September 8, 2008, the applicant stated that it had performed a detailed review of the plant physical drawings and had identified the portion of the nonsafety-related piping systems, attached to safety-related SSCs, to be included within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.1.5.2-2 acceptable because the applicant had reviewed the implementation of its methodology used to identify portions of nonsafety-related SSCs attached to safety-related SSCs to be included within the scope of license renewal and had identified and included the required portions of the nonsafety-related SSCs. The staff's concern described in RAI 2.1.5.2-2 is resolved.

<u>Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs</u>. The applicant considered physical impacts (pipe whip, jet impingement), harsh environments, flooding, spray, and leakage when evaluating the potential for spatial interactions between nonsafety-related systems and safety-related SSCs. The applicant used a spaces approach to identify the portions of nonsafety-related systems with the potential for spatial interaction with safety-related SSCs. The staff notes that the spaces approach focuses on the interaction between nonsafety-related and safety-related SSCs located in the same space, which is defined for the purposes of this review as a structure containing active or passive safety-related SSCs.

<u>Physical Impact or Flooding</u>. The applicant identified the nonsafety-related SSCs by performing a review of engineering drawings and the UFSAR. The applicant's review of earthquake experience identified no occurrence of welded steel pipe segments falling due to a strong motion earthquake. Using the guidance in NEI 95-10, the applicant concluded that as long as the effects of aging on supports for piping systems are managed, collapse of piping systems is not credible (except due to flow-accelerated corrosion as considered in the high energy line break (HELB) analysis for high energy systems), and the piping sections are not required to be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) due to a physical impact hazard. The applicant determined that high-energy lines are included in scope under 10 CFR 54.4(a)(1) or 10 CFR 54.4(a)(2), depending upon their safety classification and location. The applicant's review of industry experience showed that physical impacts can occur due to high-energy piping failures caused by flow-accelerated corrosion. The applicant also determined that nonsafety-related high-energy piping with a potential for spatial interaction with vulnerable safety-related equipment that is not protected from the effects of a HELB failure were included within scope under 10 CFR 54.4(a)(2). The applicant evaluated the missiles that could be generated from internal or external events. The nonsafety-related design features that protect safety-related SSCs from such missiles

were included within the scope of license renewal. The applicant considered nonsafety-related flood protection features such as walls, dikes, curbs, and seals for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). Flood protection features were evaluated with the structures in which they are located as a commodity.

Pipe Whip, Jet Impingement, and Harsh Environment. The applicant evaluated the nonsafety-related portions of high energy lines pursuant to 10 CFR 54.4(a)(2). The applicant based its evaluation on a review of documents including the UFSAR, design basis documents, and plant-specific documentation. The applicant evaluated its high energy systems to ensure identification of components that are part of nonsafety-related, high energy lines that can affect safety-related equipment.

Spray and Leakage. The applicant evaluated moderate and low energy systems that have the potential for spatial interactions due to spray or leakage. Nonsafety-related moderate and low-energy 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, were considered within the scope of license renewal. The applicant used a spaces approach to identify the nonsafety-related SSCs located within the same space as safety-related SSCs, as described above. After identifying the applicable mechanical systems, the applicant identified corresponding structures for potential spatial interaction based on a review of the CLB and plant walkdowns. Nonsafety-related systems and components that contain water, oil, or steam, and are located inside structures that contain safety-related SSCs, were included within the scope of license renewal, unless they were in an excluded room. Based on plant and industry operating experience, the applicant excluded the nonsafety-related SSCs containing air or gas from the scope of license renewal, with the exception of portions that are attached to safety-related SSCs and required for structural support. Those nonsafety-related SSCs determined to contain fluid, and located within a space containing safety-related SSCs, were included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

Protective Features. The applicant evaluated protective features such as whip restraints, spray shields, supports, and missile and flood barriers installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs due to fluid leakage, spray, or flooding. Protective features credited in the plant design, and all equipment supports in safety-related areas, were included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

During the audit, the staff performed a walk-down of the turbine building and determined that a portion of the turbine building contained fluid-filled, nonsafety-related systems which were not included within the scope of license renewal (referred to by the applicant as an "excluded area"). The staff noted that since the turbine building is generally an open space, the excluded area was effectively located in the same room as safety-related containment isolation valves (CA-V-5A and CA-V-5B) and that the nonsafety-related, fluid filled SSCs were not located in an excluded room as described in LRA Section 2.1.5.2. In RAI 2.1.5.2-3, the staff requested that the applicant provide additional information regarding the applicant’s rationale for excluding nonsafety-related, fluid-filled SSCs from the scope of license renewal when the SSCs are located in the same room as safety-related SSCs.

In its response to the RAI dated September 8, 2008, the applicant stated that it had determined that the scoping of nonsafety-related secondary services system components in the turbine building should have been identified as an exception to the spaces methodology used to determine nonsafety-related SSCs which could impact safety-related SSCs through spatial interaction, as discussed in the LRA. The applicant also stated that because of the configuration of the nonsafety-related secondary services system components, and the relationship of this area of the turbine building to the adjacent areas containing safety-related SSCs, the secondary service system components were determined to not have the potential for spatial interaction with safety-related SSCs.

Based on its review, the staff finds the applicant's response to RAI 2.1.5.2-3 acceptable because the applicant had reviewed the physical relationship between the secondary service components and the safety-related SSCs and determined that there was no potential for spatial interaction between the nonsafety-related SSCs and the safety-related SSCs, and because the applicant had taken exception to the spaces approach discussed in the LRA. In addition, during the scoping and screening methodology audit, the staff performed a walk down of the turbine building, identified the secondary service components and the nearest safety-related SSCs, and determined that although they were technically located in the same space, as defined in the LRA, there were substantial barriers separating the two sets of SSCs. The staff determined that the substantial barriers provided a basis for the applicant's exception to the spaces approach discussed in the LRA, in this particular application. The staff's concern described in RAI 2.1.5.2-3 is resolved.

2.1.4.2.3 Conclusion

On the basis of its review of the applicant's scoping process and systems (on a sampling basis), discussions with the applicant, and review of the information provided in the responses to the RAIs, the staff concludes that the applicant's methodology for identifying and including nonsafety-related SSCs, that could affect the performance of safety-related SSCs within the scope of license renewal is consistent with the scoping criteria 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

LRA Section 2.1.3.4, "Systems and Structures Credited for Regulated Events," describes the methodology for identifying those systems and structures within the scope of license renewal in accordance with the Commission's criteria for five regulated events: (1) 10 CFR 50.48, "Fire Protection;" (2) 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants;" (3) 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events;" (4) 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants;" and (5) 10 CFR 50.63, "Loss of All Alternating Current Power."

Fire Protection. LRA Section 2.1.3.4, "Systems and Structures Credited for Regulated Events," subsection "Fire Protection," describes scoping of systems and structures relied on in safety analyses or plant evaluations to perform functions that demonstrate compliance with the fire protection criterion. The LRA states that all SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance 10 CFR 50.48 were included in the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3). Additionally, the LRA states that fire protection SSCs necessary to minimize the effects of a fire and prevent radioactive material from being released to the environment are included in the scope of license renewal in accordance with NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 9.5.1, Appendix C, Revision 5 [*sic*] and NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 1.

Environmental Qualification. LRA Section 2.1.3.4, "Systems and Structures Credited for Regulated Events," subsection "Environmental Qualification (EQ)," describes the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the EQ criterion. The LRA states that equipment was determined to be within the scope of license renewal in accordance with 10 CFR 50.49(b)(1), 10 CFR 50.49(b)(2), and 10 CFR 50.49(b)(3), including safety-related electrical equipment; nonsafety-related electrical equipment, whose failure under postulated environmental conditions could prevent compliance with safety functions of the safety-related equipment; and certain post-accident monitoring equipment. A list of these SSCs is included in the EQ basis document, and they are in scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

Pressurized Thermal Shock. LRA Section 2.1.3.4, "Systems and Structures Credited for Regulated Events," subsection "Pressurized Thermal Shock (PTS)," describes the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the PTS criterion. The LRA states that the TMI-1 reactor vessel meets the requirements of 10 CFR 50.61 through the end of its current 40-year license period. Fluence projections were completed to meet a 60-year license period. Components that are projected to meet the definition of beltline material after 60 years of neutron exposure were identified. The PTS onsite basis document summarizes the results of a PTS review of the CLB, and lists the systems containing components credited in PTS evaluations. These systems are included in the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

Anticipated Transient Without Scram. LRA Section 2.1.3.4, "Systems and Structures Credited for Regulated Events," subsection "Anticipate Transients Without Scram (ATWS)," describes the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the ATWS criterion. The LRA states that the diverse scram system needed to mitigate the consequences of an ATWS event are met through a combination of the ATWS mitigation system actuation circuitry (AMSAC), the diverse scram system (DSS), the main turbine trip from feedwater pump trip (TTFWPT), and the heat sink protection system (HSPS). The ATWS onsite basis document lists systems required by 10 CFR 50.62 and structures that are credited with providing physical support and protection for the ATWS systems. The systems and structures are in the scope of license renewal in accordance with the requirements of 10 CFR 50.62 and 10 CFR 54.4(a)(3).

Station Blackout. LRA Section 2.1.3.4, "Systems and Structures Credited for Regulated Events," subsection "Station Blackout (SBO)," describes scoping of systems and structures relied on in safety analyses or plant evaluations to perform functions in compliance with the SBO criterion. The LRA states that TMI-1 implemented plant modifications and procedures in response to 10 CFR 50.63 to enable the station to withstand and recover from a SBO of a specified duration and that compliance with 10 CFR 50.63 is documented in UFSAR Section 8.5, staff SERs, and other correspondence related to the SBO rule. The LRA states that the applicant incorporated into its scoping methodology SRP-LR and GALL Report guidance on scoping of equipment relied on to meet the requirements of 10 CFR 50.63 and concluded that SSC that are required to recover from a SBO event are in scope of license renewal. The SBO basis document summarizes the results of a SBO review of the CLB, and lists the SSCs identified as being in the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3) which include: the switchyard bus and connections, transmission conductors and connections, high voltage insulators, disconnect switches, circuit breakers, substation structures and supports, transformers and auxiliaries, and metal enclosed bus.

2.1.4.3.2 Staff Evaluation

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

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

Fire Protection. LRA Section 2.1.3.4 describes the SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the fire protection criterion. The LRA stated that in-scope systems and structures for fire protection include those required to demonstrate post-fire safe shutdown capabilities, those required for fire detection and suppression and those required to meet commitments made to Appendix A to Branch Technical Position on Auxiliary Power Conversion System BTP-APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976." The applicant stated that those SSCs credited with fire prevention, detection, and mitigation in areas containing equipment important to the plant's safe operation and equipment credited to achieve safe shutdown in the event of a fire are within the scope of license renewal. The applicant's basis documents indicated that it had included systems and structures in the scope of license renewal required for post-fire safe shutdown, fire detection suppression, and commitments made to Appendix A to BTP-APCSB 9.5-1.

The applicant considered CLB documents to identify systems and structures within the scope of license renewal. These documents include the UFSAR, system flow diagrams, fire hazards analysis report, system design description for remote shutdown, piping drawings, operating procedures, and system design basis documents. The staff reviewed the scoping results in conjunction with the LRA and CLB information to validate the methodology for including the systems and structures within the scope of license renewal. The staff finds that the scoping results include systems and structures that perform intended functions to meet the requirements of 10 CFR 50.48. The staff determined that the applicant's scoping methodology was adequate for including SSCs credited with performing fire protection functions within the scope of license renewal.

Environmental Qualification. The applicant used the CRL to search and identify the EQ items. The CRL includes component data with an EQ data field. The staff reviewed the LRA, implementing procedures, and scoping results to verify that the applicant had identified SSCs within the scope of license renewal. The staff determined that the applicant's scoping methodology was adequate for identifying EQ SSCs within the scope of license renewal.

Pressurized Thermal Shock. The applicant included the steel reactor vessel beltline shell, including plates, forgings, and welds, within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) criteria. These components were analyzed, and fluence projections were completed to demonstrate compliance with 10 CFR 50.61. The staff reviewed the scoping basis document to verify the systems and components needed to demonstrate compliance with the requirements of 10 CFR 50.61. Additionally, the staff reviewed the scoping basis documents and determined that the methodology was appropriate for identifying SSCs with functions credited for complying with the PTS regulation and within the scope of license renewal. The staff finds that the scoping results, which included the steel reactor vessel beltline shell, include systems and structures that perform intended functions to meet the requirements of 10 CFR 50.61. The staff determined that the applicant's scoping methodology was adequate for including SSCs credited in meeting PTS requirements within the scope of license renewal.

Anticipated Transient Without Scram. The applicant generated a list of TMI-1 plant systems credited for ATWS mitigation based on its review of the CRL, UFSAR, Technical Specifications, and NRC correspondence, including NRC Letter C311-89-3001, "NRC Review of ATWS Implementation," 10 CFR 50.62 safety evaluations, and approved system design descriptions. The staff reviewed these documents and the LRA, in conjunction with the scoping results, to validate the methodology for identifying ATWS systems and structures that are within the scope of license renewal. The staff found that the scoping results included systems and structures that perform intended functions meeting 10 CFR 50.62 requirements. The staff determined that the applicant's scoping methodology was adequate for identifying SSCs with functions credited for complying with the ATWS regulation.

Station Blackout. The applicant followed a two-step process to identify SSCs credited with performing intended functions to comply with the SBO requirement. The first step identified those systems and structures associated with coping and safe shutdown of the plant following an SBO event. The second step identified those systems and structures that are required to restore the plant following the SBO event. In order to identify SBO systems and structures involved in shutdown and restoration, the applicant reviewed its restoration procedures, its SBO evaluation report, relevant mechanical and electrical diagrams, and UFSAR Sections 8.2 (Electrical System Design) and 8.5 (SBO evaluation). The staff reviewed these documents and the LRA in conjunction with the scoping results to validate the applicant's methodology. The staff finds that the scoping results included systems and structures that perform intended functions to meet the requirements of 10 CFR 50.63. The staff determined that the applicant's scoping methodology was adequate for identifying SSCs with functions credited in complying with the SBO regulations.

2.1.4.3.3 Conclusion

On the basis of the sample reviews, discussions with the applicant, review of the LRA, and review of the applicant's scoping process, the staff concludes that the applicant's methodology for identifying systems and structures meets the scoping criteria of 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 documented its methodology for performing the scoping of systems and structures in accordance with the requirements of 10 CFR 54.4(a) in the LRA, guidance documents, and scoping and screening reports. The applicant's approach to system and structure-level scoping provided in the site guidance documents and implementing procedures is consistent with the methodology described in LRA Section 2.1. Specifically, the procedures specify that the personnel performing license renewal scoping use CLB documents and describe the system or structure, and include a list of functions that the system or structure is required to accomplish. Sources of information include the UFSAR, preliminary safety analysis report, fire hazards analysis report, EQ master list, design basis documents, maintenance rule information, controlled plant component database, plant drawings, and docketed correspondence. The applicant then compared identified systems or structures function lists to the scoping criteria to determine whether the functions met the scoping criteria of 10 CFR 54.4(a).

If any part of a system or structure met any of the license renewal scoping criteria, the system or structure was included in the scope of license renewal. The system and structure scoping results included an overall system/structure description, an evaluation of each of the 10 CFR 54.4(a) scoping criteria, and the basis for the conclusion reached. The applicant developed evaluation boundaries to document the system and structure-level scoping determinations, and to define the in-scope SSCs to support the subsequent screening and AMR processes. The boundaries for the in-scope systems and structures were defined and documented in a manner for each discipline that assured the in-scope SSCs were included in the screening process.

Component Level Scoping. After the applicant identified the intended functions of systems or structures within the scope of license renewal, a review was performed to determine which components and structures support the system's license renewal intended functions. The components that support intended functions were considered within the scope of license renewal and screened to determine if an AMR was required. The applicant considered three groups of SCs while performing component level scoping: (1) mechanical, (2) structural, and (3) electrical.

Commodity Groups Scoping. The applicant applied commodity group scoping to structural and electrical SCs as discussed in LRA Sections 2.4.13, 2.4.17, and 2.5.2.

Insulation. LRA Section 2.4.13, "Structural Commodities," states that designated insulation inside the reactor building is safety-related and is required to resist seismic loading conditions and is in scope for license renewal. The applicant further stated that nonsafety-related piping and component insulation is included within the scope of license renewal when it is located inside structures within the scope of license renewal, or if it performs a function for freeze protection of heat traced piping and components. The applicant further stated that anti-sweat piping and component insulation, and thermal piping and component insulation inside structures that are not in the scope of license renewal, are not included in the scope of license renewal.

Consumables. LRA Section 2.1.6.4, "Consumables," describes the consumables to be included within the scope of license renewal. The staff noted that the information in Table 2.1-3 of the SRP-LR was used to categorize and evaluate consumables. The applicant divided consumables into the following four categories for the purpose of license renewal: (a) packing, gaskets, seals, and O-rings; (b) structural sealants; (c) oil, grease, and component filters; and (d) system filters, fire extinguishers, fire hoses, and air packs. A discussion of each category follows:

(a) The staff notes that packing, gaskets, seals, and O-rings are typically used to provide a leakproof seal when components are mechanically joined together and that these items are commonly found in components such as valves, pumps, heat exchangers, ventilations units or ducts, and piping segments. The applicant stated that based on ANSI B31.1 and the ASME B&PV Code Section III, the subcomponents of pressure-retaining components are not pressure-retaining parts, and therefore, these subcomponents are not relied on to perform a pressure boundary intended function and are not subject to an AMR.

(b) The staff noted that limited situations may exist in which materials are important in maintaining the integrity of the components to which they are connected and that structural sealants are subject to an AMR and are evaluated with the structures that contain them. The applicant stated that AMRs were required for structural sealants in in-scope structures.

(c) The applicant stated that oil, grease, and component filters have been treated as consumables because they are short-lived and periodically replaced. The applicant further stated that plant procedures are used for the replacement of oil, grease, and filters in components that are within the scope of license renewal.

(d) The applicant stated that system filters are replaced in accordance with plant procedures which are based on vendor manufacturers' requirements and system testing. The applicant further stated that fire extinguishers, fire hoses, and air packs are periodically tested, inspected, and replaced based on condition. The applicant stated that periodic inspections are implemented by plant procedures and that system filters, fire extinguishers, fire hoses, and air packs are within the scope of license renewal, but not subject to an AMR.

2.1.4.4.2 Staff Evaluation

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

The applicant documented the results of the plant-level scoping process in accordance with the guidance documents. The results were provided in the systems and structures documents and reports which contained information including a description of the system or structure, a listing of functions performed by the system or structure, identification of intended functions, the 10 CFR 54.4(a) scoping criteria met by the system or structure, references, and the basis for the classification of the system or structure intended functions. During the audit, the staff reviewed a sampling of the documents and reports 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

On the basis of its review of the LRA, scoping and screening implementing procedures, and a sampling of system scoping results during the audit, the staff concludes that the applicant's methodology for plant-level scoping appropriately identifies systems, structures, component types, and commodity groups within the scope of license renewal and their intended functions in accordance 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

LRA Section 2.1.1 describes the methodology for identifying license renewal evaluation boundaries. The staff notes that for mechanical systems, the mechanical components include those portions of the system that are necessary to ensure that the intended functions will be performed. The applicant stated that in-scope boundaries for mechanical systems and structures were developed and are depicted on the license renewal boundary drawings. The mechanical boundary drawings show the mechanical components within the scope of license renewal, including those components that are only within the scope of license renewal in accordance with 10 CFR 54.4(a)(2), using color-coding. The staff noted that end points for the portions within the scope of license renewal were clearly delineated and that notes were added to the drawings as necessary to clarify the endpoints when they do not occur at a component or feature already depicted on the drawing.

The applicant stated that for mechanical systems, the mechanical components that support the system intended functions were included in the scope of license renewal and are depicted on the applicable system flow diagrams. The applicant further stated that mechanical system flow diagrams were used to create license renewal boundary drawings showing the in-scope components. The applicant stated that components that are required to support a safety-related function, or a function that demonstrates compliance with one of the license renewal regulated events, were identified on the system flow diagrams by green highlighting and that nonsafety-related components that are connected to safety-related components and are required to provide structural support at the safety/nonsafety interface, or components whose failure could prevent satisfactory accomplishment of a safety-related function due to spatial interaction with safety-related SSCs, were identified by red highlighting. The staff conducted a review of component information contained in the CRL and confirmed the scope of components in the system and conducted plant walkdowns as necessary to obtain additional information.

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Section 2.1.5 and the guidance in the applicant’s implementing procedures and system and structure scoping report, to perform the review of the mechanical component scoping process. The staff noted that the implementing procedures provide instructions for identifying the evaluation boundaries and that determination of the mechanical system evaluation boundaries required an understanding of system operations in support of intended functions.

This process was based on the review of the UFSAR, preliminary safety analysis report, fire hazards analysis report, EQ master list, design basis documents, maintenance rule information, controlled plant component database, plant drawings, and docketed correspondence. The evaluation boundaries for mechanical systems were documented on license renewal boundary drawings that were created by marking mechanical piping and instrumentation diagrams to indicate the components within the scope of license renewal. Components within the evaluation boundary were reviewed to determine whether they perform an intended function. Intended functions were established based on whether a particular function of a component was necessary to support the system functions that meet the scoping criteria.

The staff reviewed the implementing procedures and CLB documents associated with mechanical system scoping, and found that the guidance and CLB source information noted above were acceptable to identify mechanical components and support structures in mechanical systems that are within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project management staff and reviewed documentation pertinent to the scoping process. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's proceduralized methodology was consistent with the description provided in the LRA Section 2.1.5 and the guidance contained in the SRP-LR, Section 2.1, and was adequately implemented.

During the scoping and screening methodology audit, the staff discussed the scoping methodology and, on a sampling basis, reviewed the applicant's scoping reports for identifying main steam system and decay heat removal system mechanical component types meeting the scoping criteria as defined in the Rule. The staff also reviewed the scoping methodology implementing procedures and discussed the methodology and results with the applicant. The staff confirmed that the applicant had identified and used pertinent engineering and licensing information to determine the main steam and decay heat removal system mechanical component types required to be within the scope of license renewal. As part of the review process, the staff evaluated each system intended function identified for the main steam and decay heat removal systems, the basis for inclusion of the intended function, and the process used to identify each of the system component types. The staff verified that the applicant had identified and highlighted system piping and instrumentation diagrams (P&IDs) to develop the license renewal boundaries in accordance with the procedural guidance. The applicant was knowledgeable about the process and conventions for establishing boundaries as defined in the license renewal implementing procedures.

Additionally, the staff confirmed that the applicant had peer reviewed the results in accordance with the governing procedures. Specifically, other license renewal staff knowledgeable about the system had independently reviewed the marked-up drawings to ensure accurate identification of system intended functions. The applicant performed additional cross-discipline verification and independent reviews of the resultant highlighted drawings before final approval of the scoping effort.

2.1.4.5.3 Conclusion

On the basis of its review of the LRA, scoping implementing procedures, the sample system review, and discussions with the applicant, the staff concludes that the applicant's methodology for mechanical component scoping appropriately identifies mechanical systems within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4, and therefore, is acceptable.

2.1.4.6 Structural Scoping

2.1.4.6.1 Technical Information in the Application

In addition to the information previously discussed in Section 2.1.4.4.1, LRA Section 2.1.5.5 "Scoping Boundary Determination," subsection "Structures," stated that for the structural scoping effort, the structures were determined to be within the scope of license renewal through a review of applicable plant design drawings of the structure, and confirmed through plant walkdowns. The applicant identified the structures determined to be within the scope of license renewal, and were included in a marked-up onsite site plan boundary layout drawing.

2.1.4.6.2 Staff Evaluation

The staff reviewed the applicant's approach to the scoping of structures relied upon to perform the functions described in 10 CFR 54.4(a). As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the review, and evaluated the scoping results for a sample of structures that were identified within the scope of license renewal. The applicant had identified and developed a list of plant structures and the structures intended functions through a review of UFSAR, CRL, design basis documents (DBDs), plant engineering drawings, plant operating manuals and procedures, plant walkdowns, and docketed correspondence. Each structure the applicant identified was evaluated against the criteria of 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The staff reviewed selected portions of the UFSAR, CRL, database screening form, process flowchart, structural drawings, and implementing procedures to verify the adequacy of the methodology. During the scoping and screening methodology audit, the staff discussed the scoping methodology with the applicant and, on a sampling basis, reviewed the applicant's scoping reports, including information contained in the source documentation, for the turbine building and the intermediate building to verify that application of the methodology would provide the results as documented in the LRA. The staff reviewed the applicant's methodology for identifying structures meeting the scoping criteria as defined in the Rule. The staff verified that the applicant had identified and used pertinent engineering and licensing information in order to determine that the turbine building and the intermediate building are required to be within the scope of license renewal. As part of the review process, the staff evaluated the intended functions identified for the turbine building and the intermediate building and the components, the basis for inclusion of the intended function, and the process used to identify each of the component types.

2.1.4.6.3 Conclusion

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

2.1.4.7 Electrical Component Scoping

2.1.4.7.1 Technical Information in the Application

LRA Section 2.1.1, "Introduction," states that the scoping process for electrical and instrumentation and control (I&C) systems was performed in a manner similar to the scoping process that was applied to mechanical systems and structures. Electrical and I&C components within the in-scope mechanical systems and the in-scope electrical and I&C systems were included within the scope of license renewal, regardless of the intended function of the component, which is the result of a "bounding" approach for the review of electrical components. LRA Section 2.1.6.1 states that after the scoping of electrical and I&C components was performed, the in-scope electrical components were categorized into electrical commodity groups. The staff noted that the commodity groups include similar electrical and I&C components with common characteristics and that component level intended functions of the commodity groups were identified. That staff noted that during the screening process, some commodity groups were removed from further review.

2.1.4.7.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.1, 2.1.5.5, and 2.5, and the applicant's implementing procedures, bases documents, and AMR reports that governed the electrical component scoping methodology. Based on its review, the staff finds that the applicant reviewed the electrical and I&C systems in accordance with the requirements of 10 CFR 54.4 and correctly determined which systems are to be included within the scope of license renewal. The staff noted that during the scoping process, the applicant used the UFSAR, DBDs, plant engineering drawings, docketed correspondence, plant specifications, and the CRL in making its determination.

All electrical and I&C components contained in license renewal systems and electrical systems contained in mechanical or structural systems were included within the scope of license renewal. The applicant performed a review of fuse holders as a commodity group. The applicant reviewed the CRL, plant drawings, and performed walkdowns to determine the fuse holders to be included within the scope of license renewal. The applicant reviewed the UFSAR, design records, procedures, corrective action program, and industry operating experience to determine if the application of tie-wraps had been credited for tie-wrap use, or if nonsafety-related tie-wraps could affect a safety-related function. The applicant did not identify any tie-wraps to be included within the scope of license renewal. The staff reviewed selected portions of the applicant's data sources and selected several examples of components for which the applicant demonstrated the process used to determine the electrical components that were within the scope of license renewal.

2.1.4.7.3 Conclusion

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

2.1.4.8 Scoping Methodology Conclusion

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

2.1.5 Screening Methodology

2.1.5.1 General Screening Methodology

2.1.5.1.1 Technical Information in the Application

LRA Section 2.1.6, "Screening Procedure," describes the process for determining which components and structural elements require an AMR. LRA Section 2.1.6.1 states that screening identifies SCs within the scope of license renewal that perform an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties, and that are not subject to replacement based on a qualified life or specified time period. The applicant's screening process determined the SCs subject to an AMR by:

- Listing the in-scope SCs by component type using the scoping results for a particular system or structure
- "Screening" the component types for the passive and long-lived criteria
- Identifying the intended function(s) performed by the passive and long-lived SCs by component type for the in-scope system or structure

The result was a tabulation of the in-scope passive long-lived SCs that perform intended functions and therefore require an AMR. The applicant stated that it screened SCs in accordance with the recommendations of NEI 95-10 and that "active" and "short-lived" determinations were made consistent with NEI 95-10. Accordingly, the applicant explained it "screened out" components or structural elements that were either active or subject to replacement based on a qualified life and determined that these SCs were not subject to an AMR.

2.1.5.1.2 Staff Evaluation

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

The staff reviewed the methodology used by the applicant to determine if mechanical and structural components and electrical commodity groups within the scope of license renewal should be subject to an AMR. The applicant implemented a process for determining which SCs were subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). In LRA Section 2.1.6, the applicant discussed these screening activities as they related to the component types and commodity groups within the scope of license renewal.

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 Section 2.3, "Scoping and Screening Results: Mechanical;" Section 2.4, "Scoping and Screening Results: Structures;" and Section 2.5, "Scoping and Screening Results: Electrical Systems/Commodity Groups" of the LRA that provided the results of the process used to identify component types and commodity groups subject to an AMR. The staff also reviewed the screening results reports for the main steam system, the decay heat removal system, the turbine building, and the intermediate building.
The applicant provided the staff with a detailed discussion of the processes used for each discipline and provided administrative documentation that described the screening methodology. Specific methodology for mechanical, electrical, and structural is discussed below.

2.1.5.1.3 Conclusion

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

2.1.5.2 Mechanical Component Screening

2.1.5.2.1 Technical Information in the Application

LRA Section 2.1.6.1, "Identification of Structures and Components Subject to AMR," subsection "Mechanical Systems," describes the screening methodology for identifying passive and long-lived mechanical components and their support structures that are subject to an AMR. According to the LRA, the mechanical system screening process began with the results from the scoping process. For in-scope mechanical systems, the applicant developed written system descriptions and used system flow diagrams to identify the in-scope system boundary which resulted in the license renewal boundary drawing for the mechanical system. The applicant states that it reviewed the system boundary drawings to identify the passive, long-lived components. The identified passive, long-lived components were then entered into the license renewal database. Component listings from the CRL were also reviewed to confirm that all system components were considered. In cases where the system flow diagram did not provide sufficient detail, such as for some large vendor supplied components (e.g., compressors, emergency diesel generators), the associated component drawings or vendor manuals were also reviewed. In addition, plant walkdowns were performed when required for confirmation. The identified list of passive, long-lived system components was compared to previous license renewal applications containing a similar system. Mechanical components were screened with the system in which they were scoped. For heat exchangers and coolers that are in scope only for 10 CFR 54.4 (a)(2) spatial interactions, the materials, environments and aging effects on both sides of the heat transfer surfaces were evaluated with the system that performs the cooling function. For heat exchangers and coolers that are in scope for 10 CFR 54.4(a)(2) only, each side of the heat exchanger or cooler was evaluated separately with the system associated with the process environment.

2.1.5.2.2 Staff Evaluation

The staff evaluated the mechanical screening methodology discussed and documented in LRA Section 2.1.6.1, the implementing guidance documents, the AMR reports, and the license renewal drawings. The staff noted that the applicant reviewed each system evaluation boundary as illustrated on P&IDs to identify passive and long-lived components. The staff noted that within the system evaluation boundaries, all passive, long-lived components that perform or support an intended function were subject to an AMR. The staff noted that the applicant documented its review in the AMR reports that contain information such as the information sources reviewed and the system intended functions.

The staff reviewed the results of the applicant's boundary evaluations and discussed the process with the applicant. The staff verified that mechanical system evaluation boundaries were established for each system within the scope of license renewal and that the boundaries were determined by mapping the system intended function boundary onto P&IDs. The staff noted that the applicant reviewed the components within the system intended function boundary to determine if the component supported the system intended function. The staff also noted that those components that supported the system intended function were reviewed by the applicant to determine if the component was passive and long-lived, and therefore subject to an AMR.

The staff reviewed selected portions of design criteria documents, UFSAR, system DBDs, plant drawings, and selected AMR reports. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff assessed whether the mechanical screening methodology outlined in the LRA and procedures was appropriately implemented, and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff discussed the screening methodology and, on a sampling basis, reviewed the applicant's screening reports for the main steam and decay heat removal systems to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.2.3 Conclusion

Based on its review of the LRA, the screening implementing procedures, and a sample of the main steam and decay heat removal systems screening results, the staff concludes that the applicant's mechanical component screening methodology is consistent with SRP-LR guidance. The staff concludes that the applicant's methodology for identification of passive, long-lived mechanical components within the scope of license renewal and subject to an AMR is in accordance with the requirements of 10 CFR 54.21(a)(1), and therefore, is acceptable.

2.1.5.3 Structural Component Screening

2.1.5.3.1 Technical Information in the Application

LRA Section 2.1.6.1, "Identification of Structures and Components Subject to AMR," subsection "Structures," states that the structural component screening process began with consideration of the results from the structural scoping process. According to the LRA, drawings of the structures identified from the scoping process were reviewed to identify the passive, long-lived structures and components, and were entered into the license renewal database. For these structures, written descriptions were carried over from those prepared for the scoping portion of the process. Component listings from the component record list were also reviewed to confirm that all structural components were considered, and plant walkdowns were also conducted for additional confirmation. Additionally, the applicant benchmarked the identified list of passive, long-lived structures and components against previous license renewal applications for added assurance of completeness.

2.1.5.3.2 Staff Evaluation

The staff reviewed the applicant's methodology for identifying structural components that are subject to an AMR as required in 10 CFR 54.21(a)(1). As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the activity, and evaluated the screening results for a sample of structures that were identified within the scope of license renewal.

In addition, the staff reviewed the applicant's methodology used for structural screening described in LRA Section 2.1.6.1, and in the applicant's implementing guidance. The staff finds that the applicant performed the screening review in accordance with the implementing guidance and captured pertinent structure design information, components, materials, environments, and aging effects. The applicant confirmed the results of their review with a complete peer review on every item identified. The staff confirmed that the applicant determined that structures are inherently passive and long-lived, such that the screening of structural components and commodities was based primarily on whether they perform an intended function. The staff reviewed the applicant's structural commodities scoping report, which listed structural components, grouped as commodities based on materials of construction. The primary task performed by the applicant during the screening process was to evaluate structural components to identify intended functions as they relate to license renewal. The applicant provided the staff with additional information that described the screening methodology, as well as the implementing procedures and database forms used to complete it.

The staff reviewed selected portions of the UFSAR, DBDs, design drawings, general site layout drawings, implementing procedures, and database forms. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff assessed whether the screening methodology outlined in the LRA and implementing procedures were appropriately implemented and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit the staff discussed the screening methodology and, on a sampling basis, reviewed the applicant's screening reports for the turbine building and the intermediate building to verify proper implementation of the screening process. Based on these onsite review activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.3.3 Conclusion

On the basis of its review of information contained in the LRA, selected portions of the UFSAR, DBDs, design drawings, general site layout drawings, implementing procedures, database forms, the applicant's detailed screening implementing procedures, and a sampling review of structural screening results, the staff concludes that the applicant's methodology for the screening of structural components within the scope of license renewal and subject to an AMR is in accordance with the requirements of 10 CFR 54.21(a)(1), and therefore, is acceptable.

2.1.5.4 Electrical Component Screening

2.1.5.4.1 Summary of Technical Information in the Application

LRA Section 2.1.6.1, "Identification of Structures and Components Subject to AMR," states that electrical and I&C components within the in-scope electrical, I&C, and mechanical systems, used a bounding approach for screening. Electrical and I&C components were assigned to commodity groups based on information provided in NEI 95-10 Appendix B, SRP-LR, the EPRI License Renewal Electrical Handbook, and the plant's configuration. The commodity groups subject to AMR were identified by applying the criteria of 10 CFR 54.21(a)(1)(i). The staff notes that insulated cables and connections located inside active component enclosures are considered part of the active component, and are maintained along with the other subcomponents and piece-parts and therefore, these cables, connections, and other subcomponents are not subject to an AMR.

The applicant screened the remaining commodity groups by applying the criteria of 10 CFR 54.21(a)(1)(ii). Components in the EQ program were screened out and not subject to AMR. The remaining commodity groups were evaluated to determine those groups subject to AMR based on industry operating experience and plant configurations. Electrical commodities that require an AMR are individual passive electrical commodities that are not part of a larger active assembly, and passive commodity groups that are not subject to replacement.

The applicant identified 13 passive electrical commodity groups that meet the 10 CFR 54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration). The applicant screened the 13 commodity groups and eliminated those groups that did not have a license renewal intended function and were subject to replacement based on a qualified life for a specified time period in accordance with the criteria of 10 CFR 54.21(a)(1)(ii). The applicant identified eight electrical commodity groups which were subject to AMR:

(1) Cable connections (metallic parts)
(2) Connector contacts for electrical connectors exposed to borated water leakage
(3) Fuse holders
(4) High-voltage insulators
(5) Insulated cables and connections
(6) Metal enclosed bus
(7) Switchyard bus and connections
(8) Transmission conductors and connections

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant's methodology used for electrical component screening in LRA Sections 2.1.6.1 and 2.5.2, "Electrical Commodity Groups," the applicant's implementing procedures, bases documents, and electrical AMR reports. The applicant used the screening process described in these documents to identify the electrical commodity groups subject to AMR. The applicant used the information contained in NEI 95-10 Appendix B, SRP-LR, EPRI License Renewal Electrical Handbook, plant documents and drawings, and the CRL as data sources to identify the electrical and I&C components.

The applicant identified 13 commodity groups which were determined to meet the passive criteria in accordance with NEI 95-10. The applicant evaluated the identified passive commodities to decide whether or not they were subject to replacement based on a qualified life or specified time period (short-lived), or not subject to replacement based on a qualified life or specified time period (long-lived). The remaining passive, long-lived components were determined to be subject to an AMR. The staff reviewed the screening of selected components to confirm the correct implementation of the methodology.

The staff reviewed the LRA, procedures, electrical drawings, and a sample of the results of the screening methodology. The staff determined that the applicant's methodology was consistent with the description provided in the LRA and the applicant's implementing procedures.

2.1.5.4.3 Conclusion

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

2.1.5.5 Screening Methodology Conclusion

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

2.1.6 Summary of Evaluation Findings

On the basis of its review of the information 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, and the applicant's responses to the staff's RAIs, the staff confirms that the applicant's scoping and screening methodology was 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 54.4 and 10 CFR 54.21(a)(1), and, therefore, is acceptable. Based on its review, the staff concludes that the applicant's methodology for identifying systems and structures within the scope of license renewal and SCs requiring an AMR is acceptable.

2.2 Plant-Level Scoping Results

2.2.1 Introduction

LRA Section 2.1 describes the methodology for identifying systems and structures within the scope of license renewal. In LRA Section 2.2, the applicant used the scoping methodology to determine which systems and structures 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 the following three groups:

- Systems and structures relied upon to mitigate DBEs, as required by 10 CFR 54.4(a)(1).
- Systems and structures the failure of which could prevent satisfactory accomplishment of any safety-related functions, as required by 10 CFR 54.4(a)(2).
- Systems and structures relied on in safety analyses or plant evaluations to perform functions required by regulations referenced in 10 CFR 54.4(a)(3).

2.2.2 Summary of Technical Information in the Application

LRA Table 2.2-1 lists those mechanical systems, electrical and I&C systems, and structures that are within the scope of license renewal. Also in LRA Table 2.2-1, the applicant listed the systems and structures that do not meet the criteria specified in 10 CFR 54.4(a) and are excluded from the scope of license renewal. Based on the DBEs considered in the CLB, other CLB information relating to nonsafety-related systems and structures, and certain regulated events, the applicant identified plant-level systems and structures within the scope of license renewal as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

The purpose of the staff's evaluation was to determine whether the applicant properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4. The staff's review and evaluation of the applicant's scoping and screening methodology is provided in SER Section 2.1. In order to confirm that the applicant properly implemented its methodology in accordance with 10 CFR 54.4, the staff's review focused on the implementation results the applicant provided in LRA Table 2.2-1 to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

The staff reviewed selected systems and structures that the applicant did not identify as being within the scope of license renewal to confirm whether these excluded systems and structures performed any intended functions requiring their inclusion within the scope of license renewal. The staff's review of the applicant's implementation was conducted in accordance with the guidance in SRP-LR Section 2.2.

The staff reviewed LRA Section 2.2, the UFSAR supporting information, and applicable license renewal drawings to determine whether the applicant failed to identify any systems and structures that are required to be included within the scope of license renewal. The staff finds no omissions.

2.2.4 Conclusion

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 describes the following mechanical systems:

- Reactor vessel, internals, and reactor coolant system
- Engineered safety features systems
- Auxiliary systems
- Steam and power conversion systems

The staff evaluation of the mechanical system scoping and screening results applies to all mechanical systems reviewed. Those systems that required requests for additional information (RAIs) to be generated (if any) include an additional staff evaluation which specifically addresses the applicant's responses to the RAI(s).

In accordance with the requirement 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 verify that the applicant identified all mechanical system SCs that met the scoping criteria and were subject to an AMR, and to confirm that there were no omissions.

The staff's evaluation was performed using the evaluation methodology described here, the guidance in SRP-LR Section 2.3, and took into account (where applicable) the system functions(s) described in the UFSAR. The objective was to determine whether the applicant identified, in accordance with 10 CFR 54.4, components and supporting structures for mechanical systems that meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR in accordance with 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 applicant 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 the applicant properly screened out only: (1) SCs that have functions performed with moving parts or a change in configuration or properties or (2) SCs that are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For SCs not meeting either of these criteria, the staff confirmed the remaining SCs received an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

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

- Low safety or low risk significance.
- Little operating experience indicating likely passive failures.
- No previous LRA experience indicating a need to perform a detailed review.

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

Those systems that received an alternate review are as follows:

- 2.3.3.3 Circulating Water System
- 2.3.3.7 Cranes And Hoists
- 2.3.3.11 Fuel Handling And Fuel Storage System
- 2.3.3.12 Fuel Oil System

- 2.3.3.13 Hydrogen Monitoring System
- 2.3.3.18 Miscellaneous Floor And Equipment Drains System
- 2.3.3.21 Radwaste System
- 2.3.4.1 Condensate System
- 2.3.4.2 Condensers And Air Removal System
- 2.3.4.6 Main Generator And Auxiliary Systems

2.3.1 Reactor Vessel, Internals, and Reactor Coolant System

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

- 2.3.1.1 Reactor coolant system
- 2.3.1.2 Reactor vessel
- 2.3.1.3 Reactor vessel internals
- 2.3.1.4 Steam generator

2.3.1.1 Reactor Coolant System

2.3.1.1.1 Summary of Technical Information in the Application

LRA Section 2.3.1.1 describes the reactor coolant system (RCS). The RCS is a normally operating system designed to circulate sub-cooled reactor coolant to transfer heat from the reactor vessel (RV) core to the secondary fluid in the once through steam generators (OTSGs). The RCS consists of RCS hot leg and cold leg piping, four reactor coolant pumps (RCPs), the pressurizer, pressurizer heaters, the pressurizer surge line, and the pressurizer spray line. The purpose of the RCS is to provide reactor coolant to the RV by either forced circulation from the RCPs or natural circulation, and to transfer the heat from the coolant to the secondary fluid in the OTSGs. The coolant from the RV exits through two hot leg lines and enters the OTSGs where the heat is transferred to the secondary fluid. The primary coolant then is pumped back into the RV through the four cold legs by the four RCPs. The pressurizer and the pilot operated relief valve (PORV) and two pressurizer code safety valves maintain the RCS pressure within the prescribed limits and accommodate coolant density changes throughout operation. The RCS also serves as a boundary between the fission products and the environment. LRA Table 2.3.1-1 identifies the components subject to an AMR for the RCS by component type and intended function.

2.3.1.1.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, UFSAR, and applicable boundary drawings, the staff concludes that the applicant has appropriately identified the RCS mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an aging management review in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel

2.3.1.2.1 Summary Of Technical Information in the Application

LRA Section 2.3.1.2 describes the reactor vessel (RV) system. The RV system is a normally operating system designed to contain the pressure and heat in the core and transfer this heat to the reactor coolant. The RV system consists of the reactor vessel, the control rod drive system, and reactor servicing equipment. The RV system also provides support for the reactor vessel internals, the core, and the control rod drive mechanisms. Four primary inlet nozzles receive coolant from the four cold legs from the RCS. The coolant then flows through the core and absorbs heat from the fuel and exits through the two outlet nozzles into the two hot legs of the RCS. The control rod drive system is used to insert negative reactivity into the reactor core. The RV also provides a pressure boundary for the fluid in the vessel and acts as a boundary to keep fission products from the environment. LRA Table 2.3.1-2 identifies the components subject to an AMR for the RV system by component type and intended function.

2.3.1.2.2 Conclusion

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

2.3.1.3 Reactor Vessel Internals

2.3.1.3.1 Summary Of Technical Information In The Application

LRA Section 2.3.1.3 describes the RV internals system. The RV internals system is a normally operating system designed to generate heat in the core and transfer this heat to the reactor coolant. The RV internals system includes the fuel assemblies and the control rod assemblies. The plenum assembly and the core support assembly are major structural subassemblies of the RV internals system. These structural assemblies are used to maintain reactor core assembly geometry. The plenum assembly is a cylindrical assembly that is used to position the fuel and control rod assemblies, direct the flow out of the core, and provide resistance to hydraulic lift forces. The core support assembly is used to direct flow through the core and provides the structure to support the core. The core barrel assembly provides the area for the fuel assemblies to be loaded into and for coolant to flow upward through the fuel. The lower internals assembly provides for flow distribution and provides support and protection for core monitoring detectors. The 177 fuel assemblies are used to produce positive reactivity and provide heat for the reactor coolant to absorb. The 61 control rod assemblies are used to control the reactivity of the core and if need be shut down the reactor. LRA Table 2.3.1-3 identifies the components subject to aging management review for the reactor vessel internals by component type and intended function.

2.3.1.3.2 Conclusion

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

2.3.1.4 Steam Generators

2.3.1.4.1 Summary of Technical Information in the Application

LRA Section 2.3.1.4 describes the steam generators. The steam generators are designed to act as a heat sink for the reactor coolant. The steam generators are once through tube and shell design. The reactor coolant flows through the tubes at the head and out the lower head while the secondary fluid flows through the shell from penetrations above the midpoint of the steam generators. The secondary fluid flows down through the annulus and then upward where it receives heat from the reactor coolant flow and boils into superheated steam and then exits the steam generator. The applicant stated that it will replace the original OTSGs with enhanced OTSGs before the period of extended operation. LRA Table 2.3.1-4 identifies the components subject to aging management review for the steam generators by component type and intended function.

2.3.1.4.2 Conclusion

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

2.3.2 Engineered Safety Features

LRA Section 2.3.2, describes the engineered safety features system SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the engineered safety features system in the following LRA sections:

- Core flooding system
- Decay heat removal system
- Makeup and purification system (high pressure injection)
- Primary containment heating and ventilation system
- Reactor building spray system
- Reactor building sump and drain system

2.3.2.1 Core Flooding System

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 describes the core flooding system. The core flooding system is a passive system designed to automatically flood the core during intermediate and large reactor coolant system (RCS) pipe failures. The core flooding system will automatically discharge borated water from two tanks directly into the RV if pressure drops under 600 psig. The core flooding system consists of two tanks charged with nitrogen. These tanks are approximately two-thirds filled with borated water. During a transient, if the RCS pressure drops below the core flooding pressure of 600 psig, check valves will open and the borated water will be allowed to flow into the RV. This will cause a decrease in reactivity. Both tanks are required to re-cover the core in event of a loss of coolant accident (LOCA). LRA Table 2.3.2-1 identifies the components subject to an AMR for the core flooding system by component type and intended function.

2.3.2.1.2 Conclusion

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

2.3.2.2 Decay Heat Removal System

2.3.2.2.1 Summary of Technical Information in the Application

LRA Section 2.3.2.2 describes the decay heat removal system. The decay heat removal system removes decay heat from the core and residual heat from the RCS during the latter stages of cooldown. The system also provides auxiliary spray to the pressurizer for complete depressurization. The system can be used to inject borated water into the core following a LOCA by taking suction from the borated water storage tank and injecting it through the core flooding system. The system will also maintain the reactor coolant temperature below 140 °F during refueling. The decay heat removal system also provides an alternate way to fill and drain the fuel transfer canal. It can prevent boron precipitation after a LOCA through an auxiliary spray flow to the pressurizer. The decay heat removal system is designed so that a single failure will not prevent its functioning during a LOCA or loss of offsite power. LRA Table 2.3.2-2 identifies the components subject to an AMR for the decay heat removal system by component type and intended function.

2.3.2.2.2 Conclusion

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

2.3.2.3 Makeup and Purification System (High Pressure Injection)

2.3.2.3.1 Summary of Technical Information in the Application

LRA Section 2.3.2.3 describes the makeup and purification system (MP). The MP consists of two systems: the plant makeup and purification system and the plant chemical addition system. The MP acts to control the inventory of the RCS during normal operation. The MP also has an emergency core cooling system (ECCS) function; it can be used to inject borated water at high pressure into the RV for emergency cooling during a LOCA. The chemical addition system allows for chemistry related functions in the RCS, the spent fuel cooling system, and the radwaste system. The chemical addition system provides boric acid to primary reactor coolant and the borated water storage tank as well as providing chemical and pH control to various other systems. LRA Table 2.3.2-3 identifies the components subject to an AMR for the MP by component type and intended function.

2.3.2.3.2 Conclusion

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

2.3.2.4 Primary Containment Heating and Ventilation System

2.3.2.4.1 Summary of Technical Information in the Application

LRA Section 2.3.2.4 describes the primary containment heating and ventilation system (PCHV). The PCHV consists of the following plant systems:

(a) Penetrations Air Cooling System
(b) Reactor Building Emergency Cooling Water
(c) Reactor Building Cooling System
(d) Reactor Building Miscellaneous Heating and Ventilation Systems

The penetrations air cooling system is a normally operating, mechanical system designed to cool the containment penetrations. The system accomplishes this by supplying filtered, cooled air from the outside or from the turbine hall to the penetrations.

The reactor building emergency cooling water system is designed to limit post accident containment pressure and temperature. The system accomplishes this by providing cooling water to the reactor building air handling units via the reactor building emergency cooling coils. The system is normally in emergency standby mode.

The reactor building cooling system is designed to remove sensible and latent heat from the reactor building during normal and emergency conditions to maintain the building temperature with the range of design temperatures. The system accomplishes this by supplying filtered, cooled air to the reactor building. The system is normally in operation.

The reactor building miscellaneous heating and ventilation systems is designed to heat and cool locations around the reactor building and accomplishes this by supplying filtered, tempered air throughout the reactor building.

LRA Table 2.3.2-4 identifies the components subject to an AMR for the PCHV system by component type and intended function.

2.3.2.4.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, UFSAR, and applicable boundary drawings, the staff concludes that the applicant has appropriately identified the primary containment heating and ventilation system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.2.5 Reactor Building Spray System

2.3.2.5.1 Summary of Technical Information in the Application

LRA Section 2.3.2.5 describes the reactor building spray system as a mechanical, standby, two redundant train system designed to reduce reactor building pressure to nearly atmospheric pressure, to remove airborne fission products from the reactor building atmosphere and to minimize corrosion of equipment following a LOCA. The reactor building spray system is in scope for license renewal and has interfaces with other systems that are not in the license renewal boundary of the reactor building spray system.

The reactor building spray system removes energy from the environment by transferring heat from the higher temperature atmosphere to the lower temperature spray droplets. These droplets are discharged from spray nozzles that are arranged on two concentric spray headers located on the inside dome of the reactor building. Trisodium phosphate (TSP), added to the reactor building spray system, is used to remove airborne fission products from the reactor building atmosphere. The TSP baskets which hold the TSP are included in the scope of the reactor building license renewal system. LRA Table 2.3.2-5 identifies the components subject to aging management review for the reactor building spray system by component type and intended function.

2.3.2.5.2 Conclusion

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

2.3.2.6 Reactor Building Sump and Drain System

2.3.2.6.1 Summary of Technical Information in the Application

LRA Section 2.3.2.6 describes the reactor building sump & drain system. The reactor building sump & drain system is a passive, mechanical, system designed to collect leakage within the reactor building during normal operations and during emergency events. The reactor building sump and drain system consists of the reactor building sump, decay heat removal strainer, piping, valves and supporting instrumentation.

The reactor building sump collects and stores leakage and condensation from equipment, floor drains, the liquid discharged from the reactor building spray system and the reactor coolant lost during a LOCA. Equipment that drains to the reactor building sump includes: the reactor coolant pump mechanical seals, the makeup & purification letdown coolers and the reactor building coolers.

The reactor building sump & drain system is in scope for license renewal. The reactor building sump & drain system also has several interfaces with other systems that are not in the license renewal boundary of the reactor building sump and drain system. LRA Table 2.3.2-6 identifies the components subject to an AMR for the reactor building sump and drain system by component type and intended function.

2.3.2.6.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.3 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the reactor building sump and drain system SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

LRA Section 2.3.3, describes the auxiliary system SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the auxiliary systems in the following LRA sections:

- Auxiliary and fuel handling building ventilation system
- Auxiliary steam system
- Circulating water system
- Closed cycle cooling water system
- Containment isolation system
- Control building ventilation system
- Cranes and hoists
- Diesel generator building ventilation system
- Emergency diesel generators and auxiliary systems
- Fire protection system
- Fuel handling and fuel storage system
- Fuel oil system
- Hydrogen monitoring system
- Instrument and control air system
- Intake screen and pump house ventilation system
- Intermediate building ventilation system
- Liquid and gas sampling system
- Miscellaneous floor and equipment drains system
- Open cycle cooling water system
- Radiation monitoring system
- Radwaste system
- Service building chilled water system
- Spent fuel cooling system

- Station blackout and UPS diesel generator system
- Water treatment and distribution system

2.3.3.1 Auxiliary and Fuel Handling Building Ventilation System

2.3.3.1.1 Summary of Technical Information in the Application

LRA Section 2.3.3.1 describes the auxiliary and fuel handling building ventilation (AFBV) systems which consist of the (1) auxiliary and fuel handling buildings heating and ventilation system, (2) nuclear services closed cooling water (NSCCW) pumps and decay heat (DH) pumps cooling system, (3) spent fuel cooling pumps cooling system, and (4) fuel handling building engineered safety features ventilation system (FHBESFVS). The AFBV except for the FHBESFVS is in service during normal plant operation. The FHBESFVS is placed into operation prior to any movement of irradiated fuel within the fuel handling building.

The purpose of the AFBV is to provide filtered tempered air for ventilation to the auxiliary and fuel handling buildings, maintain a negative pressure relative to the outside environment, cool selected areas where heat generation is unusually high, and to control radioactive material released in the exhaust air.

The AFBV System supplies outside air via fans through electric heaters to the auxiliary and fuel handling buildings. It supplies cooled air via fans and air coolers to the areas where heat generation is unusually high. Exhaust air is filtered by the system prior to release.

LRA Table 2.3.3-1 identifies the components subject to an AMR for the auxiliary and fuel handling building ventilation system by component type and intended function.

2.3.3.1.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, UFSAR, and applicable boundary drawings, the staff concludes that the applicant has appropriately identified the AFBV system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an aging management review in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.2 Auxiliary Steam System

2.3.3.2.1 Summary of Technical Information in the Application

LRA Section 2.3.3.2 describes the auxiliary steam (AS) system which consists of the following plant systems: auxiliary steam, auxiliary boilers, and auxiliary boiler chemical addition systems. The purpose of the AS system is to provide steam to the main feedwater pump turbines, turbine gland seals, and feedwater heaters during startup, and to supply steam to the emergency feedwater pump turbine during shutdown, if required. It also distributes steam to heat components during all plant conditions, as required. The AS system accomplishes this by distributing steam to the supplied systems from the main steam system or the extraction steam system, when available. The AS system also provides part of the main condenser vacuum boundary, through the heating loop in the auxiliary steam boilers. LRA Table 2.3.3-2 identifies the components subject to an AMR for the auxiliary steam system by component type and intended function.

2.3.3.2.2 Conclusion

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

2.3.3.3 Circulating Water System

2.3.3.3.1 Summary of Technical Information in the Application

LRA Section 2.3.3.3 describes the circulating water (CW) system which consists of the following plant systems: mechanical components of the natural draft cooling towers (NDCTs), CW system, condenser amertap system, and CW biocide system. The CW system is a mechanical system designed to provide cooling water to the main condensers, auxiliary condensers and main and auxiliary vacuum pumps under normal operation. The CW system accomplishes this by circulating river water through the main and auxiliary condensers, and through the main and auxiliary condenser air removal system to absorb process heat which is then rejected through the two natural draft cooling towers. The system also includes a chemical injection system for the addition of chemicals that control biological growth in the system and other chemical parameters. The CW system is normally in operation and is manually controlled. LRA Table 2.3.3-3 identifies the components subject to an AMR for the circulating water system by component type and intended function.

2.3.3.3.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the CW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.4 Closed Cycle Cooling Water System

2.3.3.4.1 Summary of Technical Information in the Application

LRA Section 2.3.3.4 describes the closed cycle cooling water (CCCW) system which consists of the following plant systems: nuclear services closed cooling water system, intermediate closed cooling water system, decay heat closed cooling water system, secondary services closed cooling water system, industrial cooler system, and chemical feed for industrial coolers system. The CCCW system is an auxiliary system designed to provide intermediate loop cooling for nuclear and non-nuclear plant loads.

The CCCW system is designed to provide cooling water to both safety related and nonsafety-related components. The CCCW system accomplishes this by circulating closed cooling water through the nuclear services heat exchangers, intermediate coolers, decay heat service coolers, decay heat removal coolers, secondary services heat exchangers, and industrial coolers and other safety-related and nonsafety-related plant heat exchangers and coolers.

LRA Table 2.3.3-4 identifies the components subject to an AMR for the CCCW System by component type and intended function.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4 and UFSAR Sections 9.6.2.3, 9.3, 9.6.2.5, 9.6.2.2, 9.9.4.1.d, and 5.6.4 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 not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff's review of LRA Section 2.3.3.4 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.4-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-175, five components, which appear to be sight flow indicators according to license renewal drawing LR-302-002, are highlighted in red, indicating these components are within scope for license renewal under 10 CFR 54.4(a)(2). Typically, this component type has a leakage boundary function. Sight flow indicators are not listed in LRA Tables 2.3.3-4 and 3.3.2-4 as a component type with a leakage boundary function. The staff requested that the applicant provide additional information to justify the exclusion of the sight flow indicators from LRA Tables 2.3.3-4 and 3.3.2-4.

In its response to the RAI, dated September 16, 2008, the applicant stated that the sight flow indicators (sight glasses), shown in red on license renewal drawing LR-302-175, are within the scope of license renewal with an intended function of leakage boundary; however, they were inadvertently omitted from LRA Tables 2.3.3-4 and 3.3.2-4. Also in its response, the applicant amended the LRA by adding the component sight glasses with an intended function of leakage boundary to LRA Table 2.3.3-4, adding the material glass to LRA Section 3.3.2.1.4, and adding component type sight glasses to LRA Table 3.3.2-4 with complete AMR results.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-1 acceptable, because the applicant added "sight glasses" with an intended function of leakage boundary to LRA Tables 2.3.3-4 and 3.3.2-4, and added the material "glass" to LRA Section 3.3.2.1.4. The staff's concern described in RAI 2.3.3.4-1 is resolved.

In RAI 2.3.3.4-2, dated August 20, 2008, the staff noted that the following coolers are highlighted on their respective license renewal drawings as being within scope for license renewal; however, these coolers are not specifically listed in LRA Tables 2.3.3-4 and 3.3.2-4 as being subject to an AMR:

- Closed cycle cooling water system, intermediate coolers (IC-C-1A and IC-C-1B) on license renewal drawing LR-302-620, also on LR-302-202
- Reactor coolant pump thermal barrier heat exchangers (1A, 1B, 1C, and 1D) on license renewal drawing LR-302-620
- Makeup and purification system shown on license renewal drawing LR-302-662 and LR-302-645 (typically for the three makeup pumps MU-P-1A/B/C)
- Pump and motor lube oil coolers (MU-C-3A/B/C)
- Motor air coolers (MU-C-4A/B/C)
- Gear unit oil coolers (MU C 5A/B/C)
- Decay heat removal pumps' (DH P 1A and DH-P-1B) motor coolers, and bearing coolers, on license renewal drawing LR-302-645
- Temperature control unit (SS-C-46) on license renewal drawing LR-302-181
- Isolated phase bus duct coolers (SC-C-3A and SC-C-3B) on license renewal drawing LR-302-221

The staff requested that the applicant provide additional information to justify the exclusion of the above mentioned coolers from LRA Tables 2.3.3-4 and 3.3.2-4.

In its response to the RAI, dated September 16, 2008, the applicant stated that all the components listed the RAI 2.3.3.4-2 are within the scope of license renewal as follows:
The applicant explained that the CCCW intermediate coolers are within the scope of license renewal with a heat transfer intended function. Both sides of the heat transfer surfaces have been evaluated for license renewal under the open cycle cooling water (OCCW) system. These components are already included in LRA Tables 2.3.3-19 and 3.3.2-19 with the OCCW system and shown on license renewal drawing LR-302-202.

The applicant stated that the reactor coolant pump thermal barrier heat exchangers should have been included in LRA Tables 2.3.3-4 and 3.3.2-4 as component type "heat exchanger components (Reactor Coolant Pump Thermal Barrier)." The applicant amended the LRA by adding the component heat exchanger components (Reactor Coolant Pump Thermal Barrier) with an intended function of pressure boundary to LRA Table 2.3.3-4, and added the same component name to LRA Table 3.3.2-4 with complete AMR results.

For the remaining components described in RAI 2.3.3.4-2, the applicant stated that they should have included these components in LRA Tables 2.3.3-4 and 3.3.2-4. The applicant explained that these components should have been grouped with coolers of similar design already shown in LRA Tables 2.3.3-4 and 3.3.2-4. The applicant amended the LRA by adding the remaining components listed in the RAI to the groupings of coolers of similar design already shown or by adding new components in LRA Tables 2.3.3-4 and 3.3.2-4.

The applicant amended the LRA by adding additional AMR results for new material, environment, and aging effect combinations associated with the existing component types piping and fittings and valve body for the CCCW system.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-2 acceptable because the applicant identified the location in the LRA of the AMR for the intermediate coolers and added all the components listed in the RAI, except intermediate coolers, with intended functions of leakage boundary, pressure boundary, or heat transfer to LRA Tables 2.3.3-4 and 3.3.2-4. The staff's concern described in RAI 2.3.3.4-2 is resolved.

2.3.3.4.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the CCCW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.5 Containment Isolation System

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 describes the containment isolation (CI) system which is comprised of the plant systems that are in scope for license renewal only to perform primary containment isolation. The CI system consists of: (1) penetration pressurization system, (2) reactor building isolation system, (3) containment leak rate testing, (4) steam generator chemical cleaning system, (5) reactor building purge & kidney system, (6) nuclear plant nitrogen supply, (7) post-LOCA hydrogen recombiner system, and (8) hydrogen purge discharge system.

The purpose of the CI system is to provide containment isolation which is accomplished by providing a double barrier so that no single, credible failure or malfunction of an active component can result in intolerable leakage or loss of isolation. The installed double barriers include piping systems and isolation valves. LRA Table 2.3.3-5 identifies the components subject to an AMR for the containment isolation system by component type and intended function.

2.3.3.5.2 Conclusion

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

2.3.3.6 Control Building Ventilation System

2.3.3.6.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.6, the applicant discussed the control building ventilation (CBV) system which consists of the following plant systems: (1) control building & machine shop heating and ventilation (CBMSHV) system, (2) control building chilled water system, (3) control building compressed air system, and the (4) air intake tunnel (non-structural) system. The CBV system ventilation runs continuously.

The purpose of the CBV system is to provide filtered, tempered air to both safety-related and nonsafety-related areas of the control building by supplying both outside air from the air intake tunnel and recirculated air to rooms and areas within the control building.

During normal operation, the CBV system supplies a mixture of outside air and recirculated air to the control building. If one or more of the hazards in the outside air intake tunnel, such as smoke or combustible gasses, is detected or an abnormally high radiation level in the control room is detected following the occurrence of a design basis accident in the reactor building that results in an engineered safeguard signal, the system is automatically placed into emergency recirculation mode.

The control building chilled water system is normally in operation and supplies cooling for the CBV System ventilation coolers and the penetration air coolers. Also included in the CBV system is a dedicated compressed gas system, which provides control air and maintains necessary air pressure to operate chilled water valves and CBV air operated dampers.

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

2.3.3.6.2 Conclusion

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

2.3.3.7 Cranes and Hoists

2.3.3.7.1 Summary of Technical Information in the Application

LRA Section 2.3.3.7 describes the cranes and hoists (CH) system which consists of cranes and material handling equipment, turbine building crane, reactor building polar crane, fuel handling building crane, and river pump service crane bridge. The purpose of the CH System is to safely move material and equipment as required to support operations and maintenance activities. The CH system is comprised of load handling overhead bridge cranes, monorails, jib cranes, lifting devices, and hoists provided throughout the facility to support operation and maintenance activities. Major cranes include the reactor building polar crane, fuel handling building crane, and river pump service bridge crane.

The reactor building polar crane services the operating floor and is used to lift all heavy loads such as the reactor closure head. The fuel handling building crane is used to handle new and spent fuel. The river pump service bridge crane services the river water pumps in the intake screen and pump house.

LRA Table 2.3.3-7 identifies the components subject to an AMR for the CH System by component type and intended function.

2.3.3.7.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the CH system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.8 Diesel Generator Building Ventilation System

2.3.3.8.1 Summary of Technical Information in the Application

LRA Section 2.3.3.8 describes the diesel generator building ventilation (DGBV) system which is designed to provide filtered, tempered air to the diesel generator building and the SBO diesel generator building. The DGBV System is normally in operation.

The purpose of the DGBV System is to remove heat generated by the diesel engines and other heat generating components within the diesel generator building and the SBO diesel generator building and to maintain a controlled environment for personnel and operating equipment during all modes of operation. The DGBV System accomplishes this by supplying both outside air and recirculated air to rooms within the diesel generator building and the SBO diesel generator building. LRA Table 2.3.3-8 identifies the components subject to an AMR for the DGBV system by component type and intended function.

2.3.3.8.2 Conclusion

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

2.3.3.9 Emergency Diesel Generators and Auxiliary Systems

2.3.3.9.1 Summary of Technical Information in the Application

LRA Section 2.3.3.9 describes the emergency diesel generators and auxiliary systems (EDGA) which consist of the following plant systems: emergency diesel generators (mechanical aspects), emergency diesel generator fuel systems and emergency diesel generator support systems. The EDGA systems are designed to supply electrical power to key plant components when normal offsite power sources are not available.

The EDGA systems are standby mechanical systems designed to provide the motive force for generating electrical power for key plant components during events when normal offsite power sources are not available. The EDGA systems accomplish this by utilizing diesel engines to rotate electric generators. Fuel supply, air supply, and cooling water piping and components support emergency diesel engine operation.

LRA Table 2.3.3-9 identifies the components subject to an AMR for the EDGA Systems by component type and intended function.

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9 and UFSAR Section 8.2.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.9 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.
In RAI 2.3.3.9-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-351, the EDG air start system air compressor has a standby diesel engine used to drive the compressor in the event of a failure of the electric motor shown as not included within the scope of license renewal. The standby diesel engine includes a tank and lines containing diesel fuel. In accordance with LRA Section 2.1.5.2, the applicant used the preventive option approach to scope nonsafety-related components with a potential for physical or spatial interaction with safety-related SSCs. The preventive option is based on a spaces approach. Potential spatial interaction was assumed in any structure that contains safety-related SSCs. Nonsafety-related systems and components that contain water, oil, or steam, and that are located inside structures that contain safety-related SSCs, are included within scope for potential spatial interaction under criterion 10 CFR 54.4(a)(2), unless located in an excluded room. The standby diesel engine to the EDG air start compressor includes lines containing diesel fuel. In accordance with the applicant's methodology as described in LRA Section 2.1.5.2, this component should be included within scope under 10 CFR 54.4(a)(2). The staff requested that the applicant provide additional information to justify the exclusion of the fluid-filled tank and lines on the standby diesel engine for the EDG air start system air compressor from the scope of license renewal under 10 CFR 54.4(a)(2).

In its response to the RAI, dated September 16, 2008, the applicant stated that the fuel tank for the standby diesel engine on license renewal drawing LR-302-351 should have been included in scope and subject to an AMR. The applicant amended the LRA by adding the component type "Tank (Standby Diesel Engine)" with an intended function of leakage boundary to LRA Table 2.3.3-9 and by adding the same component type to LRA Table 3.3.2-9 with complete AMR results. The standby diesel engine fuel lines components, e.g., piping, fittings, hoses, fuel filters, and fuel pump casing are included in the EDGA systems, LRA Tables 2.3.3-9 and 3.3.2-9 under the component types "Filter Housing," "Hoses," "Piping and Fittings," and "Pump Casing (Engine-driven Fuel Oil Pump)."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-1 acceptable because the applicant included the standby diesel engine fuel tank and fuel line components in scope for license renewal and subject to an AMR. The applicant amended the LRA by adding the component "Tank (Standby Diesel Engine)" with an intended function of leakage boundary to LRA Tables 2.3.3-9 and 3.3.2-9. The staff's concern described in RAI 2.3.3.9-1 is resolved.

2.3.3.9.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the EDGA system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.10 Fire Protection System

2.3.3.10.1 Summary of Technical Information in the Application

LRA Section 2.3.3.10 describes the fire protection system, which is a normally operating mechanical system designed to provide for the rapid detection and suppression of a fire at the plant. It consists of several plant systems, including the fire detection systems, wall openings and fire stops, fire protection systems, fire protection service water, cardox fire extinguisher system for the cable room, and halon systems.

The fire protection system includes the fire protection service water system, which consists of deluge, wet pipe, and pre-action sprinkler systems, interior hose reels, and yard hydrants. The fire protection system also consists of halogenated and carbon dioxide fire suppression systems, portable fire extinguishers, fire detection and alarm systems, and the reactor coolant pump lube oil collection system. The physical plant design features include fire barrier walls and slabs, fire barrier penetration seals, fire doors and dampers, fire-rated enclosures, heat shields, combustible gas detectors, and acetylene monitoring equipment.

The purpose of the fire protection system is to reduce the likelihood of fire occurrences, promptly detect and extinguish fires if they occur, maintain capability to safely shut down the plant in the event of a fire, and prevent the subsequent release of a significant amount of radioactive material in the event of a fire. The fire protection system accomplishes this by providing fire protection in the form of detection, alarms, fire barriers, and suppression for selected areas of the plant.

The intended functions of the fire protection system within the scope of license renewal are to provide a primary containment boundary, to be dependable in safety analysis or plant evaluations, and to resist nonsafety-related SSC failure.

LRA Table 2.3.3-10 identifies the components subject to an AMR for the fire protection system by component type and intended function.

2.3.3.10.2Staff Evaluation

The staff reviewed LRA Section 2.3.3.10, UFSAR Section 9.9, 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 had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive or long-lived components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff also reviewed the fire protection CLB documents listed in Operating License Condition 2.c.4.

The staff also reviewed commitments to 10 CFR Part 50.48, “fire protection” (i.e., approved fire protection program), responses to Appendix A to Branch Technical Position (BTP), Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, “Guidelines for Fire Protection for Nuclear Power Plants,” May 1, 1976, documented in the UFSAR.

During its review of LRA Section 2.3.3.10, the staff identified areas in which additional information was necessary to complete its review of the applicant’s scoping and screening results.

In RAI 2.3.3.10-1, dated August 22, 2008, the staff noted that LRA Tables 2.3.3-10 and 3.3.2-10 exclude several types of fire protection components that are discussed in the SERs or UFSAR, and which also appear on the license renewal drawings as within the scope of license renewal.

These components are listed below:

- hose connections
- hose racks
- yard hose houses
- interior fire hose stations
- pipe supports
- buried piping
- filter housing
- flexible hose
- dikes for oil spill confinement
- buried underground fuel oil tanks for emergency diesel generators
- fire water main loop valves
- post indicator valves
- lubricating oil collection system components for each reactor coolant pump
- lubricating oil cooler
- auxiliary lubricating oil makeup tank
- floor drains and curbs for fire-fighting water
- backflow prevention devices
- flame retardant coating for cables
- fire retardant coating for structural steel supporting walls and ceilings
- thermal insulation on valves
- engine intake and exhaust silencers/muffler (diesel driven fire pump)
- heat exchangers (bonnet)
- heat exchangers (shell)
- heat exchangers (tube)

The staff requested that the applicant provide additional information to verify whether the components listed above should be included in LRA Tables 2.3.3-10 and 3.3.2-10. If they are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response to the RAI, dated September 19, 2008, the applicant provided the results of scoping and screening for the listed fire protection system component types as follows:

- Hose connections - Hose connections are included in the “piping and fittings” component category in LRA Tables 2.3.3-10 and 3.3.2-10

- Hose racks - Hose rack stations include valves, couplings, and fittings that are included in the “valve body” and “piping and fittings” component categories in LRA Tables 2.3.3-10 and 3.3.2-10. Although pressure tested in accordance with NUREG-1801 program requirements, the linen fire hose is considered consumable and is not subject to an AMR.

- Yard hose houses - Yard hose houses are nonsafety-related structures not credited with aging management of fire protection components for TMI-1 license renewal and are not subject to an AMR.

- Interior fire hose stations - Hose stations include valves, couplings, and fittings that are included in the “valve body” and "piping and fittings" component categories in LRA Tables 2.3.3-10 and 3.3.2-10. Although pressure is tested in accordance with NUREG-1801 program requirements, the linen fire hose is considered consumable and is not subject to an AMR.

- Pipe supports - Pipe supports are included under the component type of “support members, welds, bolted connections, and support anchorage to building structure” in the “component supports commodity group” in LRA Table 2.4-17.

- Buried piping - Buried fire protection piping is included in the “piping and fittings” component category in LRA Tables 2.3.3-10 and 3.3.2-10, with an environment of “soil (external)” in LRA Table 3.3.2-10.

- Filter housing - Filter housings are included in the component category of “strainer body” in LRA Tables 2.3.3-10 and 3.3.2-10.

- Flexible hose - The only (non-fire water) flexible hoses in the TMI fire protection system are part of the fire suppression system and are included in the “piping and fittings” component category in LRA Tables 2.3.3-10 and 3.3.2-10, with a material of “polymer” in LRA Table 3.3.2-10. Fire water hoses are considered consumable and are not subject to an AMR.

- Dikes for oil spill confinement - Dikes for oil spill confinement are included in the component category of “concrete curbs” in LRA Tables 2.3.3-10 and 3.3.2-10, with an intended function of “fire barrier (contain oil spills).”

- Buried underground fuel oil tanks for emergency diesel generators - The buried 30,000-gallon fuel oil tank for the emergency diesel generators is evaluated under the emergency diesel generators and auxiliary systems in LRA Table 2.3.3-9. The diesel fuel storage tanks for the diesel-driven fire pumps are above-ground tanks, evaluated with the fuel oil system in LRA Table 2.3.3-12.

- Fire water main loop valves - Fire water system valves are included in the “valve body” component type in LRA Tables 2.3.3-10 and 3.3.2-10.

- Post indicator valves - Fire water system valves are included in the “valve body” component type in LRA Tables 2.3.3-10 and 3.3.2-10.

- Lubricating oil collection system components for each reactor coolant pump - These components are found under the “piping and fittings,” “drip pan,” “valve body,” and “tanks (RC pump lube oil drain tanks)” component categories in LRA Tables 2.3.3-10 and 3.3.2-10.

- Lubricating oil cooler - This component is considered an integral subcomponent part of the fire pump diesel engine, which is considered an active component in accordance with NUREG-1800, Revision 1, Table 2.1-5, Item No. 55, and is not subject to an AMR.

- Auxiliary lubricating oil makeup tank - The TMI-1 fire protection system does not have auxiliary lubricating oil makeup tanks. The diesel engines for the fire pumps have oil sump pans that are integral subcomponents of the fire pump diesel engines, which are considered active components in accordance with NUREG-1800 Revision 1, Table 2.1-5, Item No. 55, and are not subject to aging management review.

- Floor drains and curbs for fire-fighting water - Floor drains are evaluated with the miscellaneous floor and equipment drains system in LRA Table 2.3.3-18. Concrete curbing for flood control is included with the dike/flood control system in LRA Table 2.4-6.

- Backflow prevention devices - These components are included in the “valve body” component type in LRA Tables 2.3.3-10 and 3.3.2-10.

- Flame retardant coating for cables - Thermo-lag and mecatiss fire wrap systems are evaluated under the component type “fire barriers (fire-rated enclosures)” in LRA Tables 2.3.3-10 and 3.3.2-10.

- Fire retardant coating for structural steel supporting walls and ceilings - These items are evaluated as insulation under "structural commodities" in LRA Table 2.4-13.

- Thermal insulation on valves - Thermal insulation is evaluated under “structural commodities” in LRA Table 2.4-13.

- Engine intake and exhaust silencers/muffler (diesel-driven fire pump) - These components are considered integral subcomponent parts of the fire pump diesel engines which are considered active components in accordance with NUREG-1800, Revision 1, Table 2.1-5, Item No. 55, and are not subject to an AMR.

- Heat exchanger (bonnet, shell, and tube) - These components are considered integral subcomponent parts of the fire pump diesel engines, which are considered active components in accordance with NUREG-1800, Revision 1, Table 2.1-5, Item No. 55, and are not subject to an AMR.

In reviewing the applicant’s response to the RAI, the staff found that each item in the RAI was addressed and resolved as follows.

Although the description of the “piping and fittings” line item provided in LRA Table 2.3.3-10 does not list these components specifically, the applicant states that it considers the hose connections, buried piping, flexible hose, and lubricating oil collection system components as included in LRA Table 2.3.3-10 under the component type “piping and fittings,” with the AMR results provided in LRA Table 3.3.2-10.

Further, the applicant states that it considers the hose racks, interior hose stations, fire water main loop valves, post-indicator valves, and backflow prevention devices as included in LRA Table 2.3.3-10 under the component type “valve body,” with the AMR results provided in LRA Table 3.3.2-10. Pipe supports are included under the component type of “support members,” in LRA Table 2.4-17, “component supports commodity group.” Filter housings are included in the component category of “strainer body” in LRA Tables 2.3.3-10 and 3.3.2-10. Dikes for oil spill confinement are included in the LRA Tables 2.3.3-10 and 3.3.2-10 under “concrete curbs.” Floor drains and curbs for fire-fighting water are addressed in LRA Table 2.3.3-18, “miscellaneous floor and equipment drain system.” Flame retardant coating for cables is included under components type “fire barrier” in LRA Tables 2.3.3-10 and 3.3.2-10. Fire retardant coating for structural steel supporting walls and ceilings and thermal insulation on valves are included under “structural commodities” in LRA Table 2.4-13.

Buried underground fuel oil tanks for emergency diesel generators are evaluated under “emergency diesel generators and auxiliary systems” in LRA Table 2.3.3-9.

The staff finds this portion of the applicant's response to RAI 2.3.3.10-1 acceptable because it confirmed that the components in question are within the scope of license renewal and subject to an AMR. The response also directed the staff to the AMR results in the LRA.

The staff found that the applicant appropriately excluded the following components from the line item descriptions in the LRA because these components are active, and therefore not subject to an AMR: (a) lubricating oil cooler, (b) engine intake and exhaust silencers/muffler (diesel driven fire pump), and (c) heat exchanger (bonnet, shell, and tube).

Auxiliary lubricating oil makeup tanks are not part of the fire protection systems in TMI-1. Since these components are not used in the fire protection systems at TMI-1, the staff finds that these components were appropriately omitted from the scope of license renewal.

The staff found that the yard hose houses are not within the scope of license renewal and subject to an AMR, and were not included in the line item descriptions in the LRA table. The yard fire hydrants are housed in small sheds storing tools and the accompanying fire hydrant fire hoses. Failure of a hose house, which is a second level support system, need not be considered in determining the SCs within the scope of the rule under 10 CFR 54.4(a)(3). The staff found yard hose houses were correctly excluded from the scope of license renewal and not subject to an AMR.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.10-1 acceptable, because it addresses the staff’s concerns regarding scoping, screening, and AMR of fire protection system components listed in the RAI. The staff’s concerns described in RAI 2.3.3.10-1 are resolved.

2.3.3.10.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and drawings to determine whether or not the applicant failed to identify any SCs within the scope of license renewal. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the fire protection system components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.11 Fuel Handling and Fuel Storage System

2.3.3.11.1 Summary of Technical Information in the Application

LRA Section 2.3.3.11 describes the fuel handling and fuel storage (FHS) system which consists of the following plant systems: fuel handling system, new fuel racks, and spent fuel racks. The purpose of the FHS system is to control fuel storage positions to assure a geometrically safe configuration with respect to criticality, ensure adequate shielding of irradiated fuel for plant personnel to accomplish normal operations, prevent mechanical damage to the stored fuel that could result in significant release of radioactivity from the fuel, and provide means for the safe handling of new and irradiated fuel assemblies. The FHS System accomplishes this by using storage racks to safely and securely hold new and irradiated fuel in the spent fuel pool, and by using the fuel handling bridges, cranes, and other transfer equipment to move fuel. The FHS System is used during fuel movement to, from, and within the reactor vessel or the spent fuel pools, and to store new and spent fuel. LRA Table 2.3.3-11 identifies the components subject to an AMR for the FHS System by component type and intended function.

2.3.3.11.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the FHS system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.12 Fuel Oil System

2.3.3.12.1 Summary of Technical Information in the Application

LRA Section 2.3.3.12 describes the fuel oil (FO) system, as an auxiliary system designed to store and transfer diesel fuel oil. The FO system is a standby mechanical system designed to receive, store, and transfer diesel fuel oil for use in the auxiliary boilers, emergency diesel generators, diesel fire pumps, substation emergency diesel generators, and the fire training facility. The FO system accomplishes this by providing storage tanks, transfer pumps, and piping for diesel fuel oil storage and transfer. LRA Table 2.3.3-12 identifies the components subject to an AMR for the FO system by component type and intended function.

2.3.3.12.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the FO system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.13 Hydrogen Monitoring System

2.3.3.13.1 Summary of Technical Information in the Application

LRA Section 2.3.3.13 describes the hydrogen monitoring (HM) System. The purpose of the HM system is to monitor hydrogen concentration inside the reactor building during accident and post-accident conditions. The HM system accomplishes this by circulating a sample of the reactor building atmosphere through piping and hydrogen analyzers and calculating the hydrogen concentration of that sample. The HM system is not in service during normal operation, although it is available at all times. LRA Table 2.3.3-13 identifies the components subject to an AMR for the HM system by component type and intended function.

2.3.3.13.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the HM system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.14 Instrument and Control Air System

2.3.3.14.1 Summary of Technical Information in the Application

LRA Section 2.3.3.14 describes the instrument & control air system which is a mechanical system designed to continuously deliver clean, dry pressurized air throughout the plant. The instrument & control air system includes two plant systems: the plant instrument air system, which includes the backup instrument air and two hour backup instrument air plant sub-systems; and the plant service air system. The instrument & control air system is in scope for license renewal.

The instrument & control air system supplies air to virtually every system in the plant. The system consists of compressors, air dryers, filters, receivers, inter and after coolers, storage cylinders, piping, valves and supporting instrumentation. The boundary with these systems extends up to and includes the air operator and positioner of the end user system components, such as valves, dampers and pneumatic instrumentation.

The function of the system is to continuously deliver clean, dry, pressurized air in sufficient quantities to points throughout the plant. The system utilizes a main air compressor, which in normal operation is sufficient to supply clean, dry air to plant instrument air users. When the main compressor is lost or is unable to maintain pressure, two oil free standby instrument air compressors are available, each discharging through a separate after-cooler and air receiver to a common air dryer. Two lubricated plant service air compressors provide additional backup. If instrument air system pressure continues to drop, air will automatically flow from the Service Air System, through an oil removal filter and then to the Instrument Air dryer to provide dry air to the plant.

The function of the backup instrument air system (BUIAS) is to supply undried air to critical secondary plant components on a loss of pressure. There are two BUIAS compressors and associated distribution headers, one located in the turbine building and one located in the intermediate building. The BUIAS compressor supplies air to a distribution header in the turbine building to allow equipment critical to plant shutdown to function. The BUIAS compressor supplies air to a distribution header in the intermediate building to allow the feedwater control valves and the main steam atmospheric dump valves to function.

The main function of the two hour backup instrument air system (2HBUIAS) is to provide compressed air for operation of components within the main steam, reactor river and emergency feedwater systems upon the loss of the instrument air system which may result from a design basis event such as a high energy line break, loss of offsite power, station blackout, or seismic event that could preclude reactor decay heat removal via the emergency feedwater and main steam systems.

The 2HBUIAS supplies components in the main steam, reactor river and emergency feedwater systems from two independent trains. An air compressor is provided to supply dry, filtered air to maintain the two hour air bank bottle pressure between 1700 and 2250 psig.

The compressor is operated manually when the air banks are charged. The function of the plant service air system is to provide convenient outlets throughout the plant for general compressed air use and to provide backup source of compressed air to the instrument air system.

LRA Table 2.3.3-14 identifies the components subject to an AMR for the instrument & control air system by component type and intended function.

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14 and UFSAR Sections 5.1.1, 5.3.5, 7.1.4.3, 7.3.2.2, 9.10.1, and 9.10.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.14 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.14-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-276, the two-hour backup IA charging compressor is not highlighted, indicating that the charging compressor was not included within the scope of license renewal. The charging compressor includes an oil pump and piping containing oil that operates up to 1500 psi, and is located in the EDG room, which contains safety-related equipment. Similar to the discussion in RAI 2.3.3.9-1, in accordance with the applicant's methodology, nonsafety-related systems and components that contain water, oil, or steam, and are located inside structures that contain safety-related SSCs, are included within scope of license renewal for potential spatial interaction under criterion 10 CFR 54.4(a)(2). In accordance with the applicant's methodology as described in LRA Section 2.1.5.2, the charging compressor should be included within scope of license renewal under 10 CFR 54.4(a)(2). The staff requested that the applicant provide additional information to justify the exclusion of the backup IA charging compressor from the scope of license renewal under 10 CFR 54.4(a)(2).

In its response to the RAI, dated September 16, 2008, the applicant stated the oil lines associated with the two-hour backup IA charging compressor should have been included in the scope of license renewal for leakage boundary piping on license renewal drawing LR-302-276. The applicant amended the LRA by adding the component "Piping and Fittings (Two Hour Backup Instrument Air Charging Compressor)" with an intended function of leakage boundary to LRA Table 2.3.3-14 and adding the same component type to LRA Table 3.3.2-14 with complete AMR results. In addition, the applicant amended the environments list and the aging management programs list in LRA Section 3.3.2.1.14 to add lubricating oil and an AMP: "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," respectively.

On October 23, 2008, the staff conducted a conference call with the applicant to discuss their response to RAI 2.3.3.14-1. As a result of the phone conference, the applicant clarified that in LRA Section 3.3.2.1.14, "lubricating oil" should have been listed under "Environments List" and not "Materials." The staff concurred with this correction.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-1 acceptable because the applicant added the component "Piping and Fittings (Two Hour Backup Instrument Air Charging Compressor)" with an intended function of leakage boundary to LRA Tables 2.3.3-14 and 3.3.2-14. In addition, the applicant amended LRA Section 3.3.2.1.14 to add "lubricating oil" to the environments list and an AMP: "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to the aging management programs list. Therefore, the staff's concern described in RAI 2.3.3.14-1 is resolved.

In RAI 2.3.3.14-2, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-271, the IA piping to a temperature instrument connected to after-cooler IA-C-1B is not highlighted, indicating that it is not within the scope of license renewal. The IA piping from the IA cooler to the temperature sensor is part of the pressure boundary of the IA system and should be included within scope in accordance with 10 CFR 54.4(a)(1). The IA piping up to a similar temperature instrument connected to after-cooler IA-C-1A is highlighted in green, indicating that it is within the scope of license renewal. The staff requested that the applicant provide additional information to justify the exclusion of the piping to the temperature instrument connecting to IA after-cooler IA-C-1B from the scope of license renewal.

In its response to the RAI, dated September 16, 2008, the applicant stated the IA piping up to and including the temperature instrument located on the after-cooler IA-C-1B on license renewal drawing LR-302-271 is included within the scope of license renewal, and the piping should have been highlighted on the license renewal drawing.

On October 23, 2008, the staff conducted a conference call with the applicant AmerGen to discuss their response to RAI 2.3.3.14-2 and RAI 2.3.3.17-2. As a result of the phone conference, the applicant clarified that they do not intend to make physical changes to license renewal drawings to correct license renewal drawing errors. Rather, the applicant will provide a sufficient description of needed license renewal drawing changes to adequately respond to an RAI. The staff concurred with the applicant's proposal and will submit RAIs to document any license renewal drawing discrepancy accordingly.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-2 acceptable because the applicant clarified that the piping up to and including the temperature instrument located on the IA after-cooler IA-C-1B is included in the scope of license renewal; therefore, the staff's concern described in RAI 2.3.3.14-2 is resolved.

2.3.3.14.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the instrument and control air system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.15 Intake Screen and Pump House Ventilation System

2.3.3.15.1 Summary of Technical Information in the Application

LRA Section 2.3.3.15 describes the intake screen and pump house ventilation (ISPV) system. The ISPV system is designed to provide tempered air to the intake screen and pump house. The purpose of the ISPV system is to provide filtered, tempered air to safety-related areas of the intake screen and pump house during normal plant operation. The ISPV system accomplishes this by supplying both outside and recirculated air to rooms within the intake screen and pump house. LRA Table 2.3.3-15 identifies the components subject to aging management review for the ISPV system by component type and intended function.

2.3.3.15.2 Conclusion

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

2.3.3.16 Intermediate Building Ventilation System

2.3.3.16.1 Summary of Technical Information in the Application

LRA Section 2.3.3.16 describes the intermediate building ventilation (IBV) system which consists of the intermediate building heating & ventilation system and emergency feedwater pump rooms cooling system. The purpose of the IBV system is to provide filtered, tempered air to the intermediate building. The IBV system accomplishes this by recirculating tempered air throughout the intermediate building. LRA Table 2.3.3-16 identifies the components subject to an AMR for the IBV system by component type and intended function.

2.3.3.16.2 Conclusion

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

2.3.3.17 Liquid and Gas Sampling System

2.3.3.17.1 Summary of Technical Information in the Application

LRA Section 2.3.3.17 describes the liquid and gas sampling (LGS) system which consists of the following plant systems: nuclear liquid sampling system, radgas sampling system, turbine plant sampling system, auxiliary boiler sampling system, and post accident sampling system. The LGS system is an auxiliary system designed to provide liquid, steam, and gas samples of plant processes for chemical and radiochemical analysis. The LGS system accomplishes this by transporting samples from the plant systems being sampled to the sampling sinks.

LRA Table 2.3.3-17 identifies the components subject to an AMR for the Liquid and Gas Sampling System by component type and intended function.

2.3.3.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.17, UFSAR Section 9.2.2, and UFSAR Tables 5.3-2 and 7.1-2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.17 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.
In RAI 2.3.3.17-1 dated August 20, 2008, the staff noted that on license renewal drawing LR-302-181 the primary sampling coolers tube side components are highlighted in red, indicating that they are within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria. On license renewal drawing LR-302-181 the condensate pump sample cooler tube side components are highlighted in red, indicating that they are within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria. Note 3 on license renewal drawing LR-302-181 reads: "The tube side of the Sample Coolers is evaluated for aging management with the LGS System. The shell side of the coolers is evaluated for aging management with the CCCW System." However, LRA Table 2.3.3-17 does not list these coolers as subject to an AMR. Note 4 on license renewal drawing LR-302-181 reads: "The tube side of the Condensate Pump Sample Cooler is evaluated for aging management with the LGS System. The shell side of the cooler is evaluated for aging management with the CCCW System." However, LRA Table 2.3.3-17 does not list this cooler as subject to an AMR. The staff requested that the applicant provide the following additional information:

- Justify the exclusion of the tube side of the primary sampling coolers from LRA Table 2.3.3-17 as a component subject to an AMR.
- Justify the exclusion of the tube side of the condensate pump sample cooler from LRA Table 2.3.3-17 as a component subject to an AMR.

In its response to the RAI, dated September 16, 2008, the applicant stated that the primary sample coolers on license renewal drawing LR-302-181 are tube in tube coolers and the inner tubes, which were incorrectly shown in red, are contained within the outer tubes. The applicant further stated that the nonsafety-related inner tube side of the coolers do not perform any intended functions; therefore, they are not in scope, and that the inner tube side should have been depicted in black, indicating the inner tube side is not in scope for license renewal. The applicant indicated that Note 3 on license renewal drawing LR-302-181 should have stated: "The Primary Sample Coolers are evaluated for aging management with the CCCW System." The applicant stated that the primary sample coolers are not listed in LRA Table 2.3.3-17 because the inner tube side of the coolers does not perform an intended function and the outer tube side of the coolers, which performs a leakage boundary intended function, is evaluated with the CCCW system and listed in LRA Table 2.3.3-4.

On October 23, 2008, the staff conducted a conference call with the applicant to discuss their response to RAI 2.3.3.17-1. As a result of the teleconference, the applicant clarified that for table revisions that only include one item or a very minor change, they have not been showing the table revisions in the RAI response, rather providing a description of the revision instead. The staff concurred with the applicant's response.

Based on its review, the staff finds the applicant's response to the first part of RAI 2.3.3.17-1 acceptable because the applicant clarified that the primary sample coolers are evaluated with the CCCW system and that the inner tube side of the coolers do not perform an intended function with respect to license renewal, but the outer tube side of the coolers perform a leakage boundary intended function and are listed in LRA Table 2.3.3-4 CCCW. The staff's concern described in the first part of RAI 2.3.3.17-1 is resolved.

In addressing the second part of RAI 2.3.3.17-1, the applicant stated the condensate pump sample cooler is a "tube in tube" cooler and that the outer tube of the cooler performs a leakage boundary intended function and is correctly shown in red on license renewal drawing LR-302-181; however, it was omitted from LRA Tables 2.3.3-17 and 3.3.2-17. The applicant also stated that the nonsafety-related inner tube side of the coolers do not perform any intended functions; therefore, they are not in scope and that the inner tubes are contained within the outer tubes and were incorrectly shown in red. The applicant indicated that the inner tube side should have been depicted in black, indicating the inner tube side is not in scope for license renewal. The applicant indicated that Note 4 on license renewal drawing LR-302-181 should have stated: "The Condensate Pump Sample Cooler is evaluated for aging management with the LGS System." The applicant amended the LRA by adding the component "Heat exchanger components (Condensate Pump Sample Cooler)" with an intended function of leakage boundary to LRA Table 2.3.3-17 and by adding the same component type to LRA Table-3.3.2-17 with complete aging management review results. In addition, the applicant stated that the AMP: "External Surfaces Monitoring Program" will be used to manage loss of material due to general corrosion of the condensate pump sample cooler and that LRA Table 3.3.1 Item 3.3.1-58 should include the LGS system in the discussion list of applicable systems for the External Surfaces Monitoring Program.

Based on its review, the staff finds the applicant's response to the second part of RAI 2.3.3.17-1 acceptable because the applicant clarified that the condensate pump sample cooler is evaluated with the LGS system, and that the inner tubes of the cooler are not within scope for license renewal, but the outer tube side of the cooler performs a leakage boundary intended function and is in scope for license renewal. Hence, the applicant amended the LRA by adding the component "Heat exchanger components (Condensate Pump Sample Cooler)" with an intended function of leakage boundary to LRA Tables 2.3.3-17 and 3.3.2-17. In addition, the applicant clarified that

LRA Table 3.3.1 Item 3.3.1-58 includes the LGS system in the discussion list of applicable systems for the External Surfaces Monitoring Program. The staff's concern described in the second part of RAI 2.3.3.17-1 is resolved.

In RAI 2.3.3.17-2, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-182 the chillers are highlighted in red, indicating that they are within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria. Note 3 on license renewal drawing LR-302-182 reads: "The tube side and shell side of the Chillers are evaluated for Aging Management with the LGS System." However, LRA Table 2.3.3-17 does not list these chillers as subject to an AMR. The staff requested that the applicant provide additional information to justify the exclusion of the tube side and shell side of the chillers from LRA Table 2.3.3-17 as a component subject to an AMR.

In its response to the RAI, dated September 16, 2008, the applicant stated that the secondary sample chillers, SS-C-1 and SS-C-2, are in the scope of license renewal as shown on LR-302-182 and the component type "Heat exchanger components (Secondary Sample Chillers)" should have been included in LRA Tables 2.3.3-17 and 3.3.2-17, but were omitted. The applicant amended the LRA by adding the component "Heat exchanger components (Secondary Sample Chillers)" with an intended function of leakage boundary to LRA Table 2.3.3-17 and added the same component type to LRA Table 3.3.2-17 with complete aging management review results. In addition, the applicant stated that the AMP: "External Surfaces Monitoring Program" will be used to manage loss of material due to general corrosion of the secondary sample chillers; therefore, LRA Table 3.3.1 Item 3.3.1-58 should include the LGS system in the discussion list of applicable systems for the External Surfaces Monitoring Program.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-2 acceptable because the applicant added component type "Heat exchanger components (Secondary Sample Chillers)" to LRA Tables 2.3.3-17 and 3.3.2-17. In addition, the applicant clarified that LRA Table 3.3.1, item 3.3.1-58, includes the LGS system in the discussion list of applicable systems for the External Surfaces Monitoring Program. The staff's concern described in RAI 2.3.3.17-2 is resolved.

In RAI 2.3.3.17-3, dated August 20, 2008, the staff noted that on various license renewal drawings, the applicant highlighted piping in red leading up to and out of an enclosure such as a sampling panel, indicating that the piping is within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria; however, neither the piping inside the panel nor the panel enclosure walls are shown as within scope. For example, on license renewal drawing LR-302-181 the iron sampler housing and the sampling rack just below the iron sampler are shown in black. Since these panels contain components that should be subject to an AMR for 10 CFR 54.4(a)(2), and the panel enclosures are not highlighted in red, the staff expects the internal components to be included within the scope of license renewal. The staff requested that the applicant provide additional information to justify the exclusion of the housing panels and their internal piping and components from being within scope for an AMR in accordance with 10 CFR 54.4(a)(2). In addition, the staff requested that the applicant provide additional information to explain how piping and components inside an enclosure are evaluated for inclusion within scope under 10 CFR 54.4(a)(2).

In its response to the RAI, dated September 16, 2008, the applicant stated that these enclosures, such as the iron sampler housing, are in the scope of license renewal and evaluated for license renewal in LRA Section 2.4.13, Structural Commodities, as commodity type "Cabinets, Enclosures and Panels for Electrical Equipment and Instrumentation." The applicant stated that its practice was not to highlight structural components on mechanical license renewal drawings. As indicated on license renewal drawing LR-302-181, piping up to the enclosure is required to perform a leakage boundary function; therefore, it is subject to AMR for 10 CFR 54.4(a)(2) due to the potential of spatial interaction with safety-related equipment. Piping inside the enclosure does not have a potential for spatial interaction with safety-related equipment, because the enclosure protects the safety-related equipment from spray originating from the nonsafety-related components.

On October 23, 2008, the staff conducted a conference call with the applicant to discuss their response to RAI 2.3.3.17-3. As a result of the teleconference, the applicant clarified that their inclusion of panels in the scope of license renewal under 10 CFR 54.4(a)(2) for enclosures to prevent the interaction of non-safety related components with safety related components was not intended to contradict their statement of non-use of the mitigative approach discussed in LRA Section 2.1. The staff reviewed the applicant's response and determined there were no negative effects to the components the applicant included in their scoping or screening process.

Based on its review, the staff found the applicant's response to RAI 2.3.3.17-3 acceptable because the applicant clarified that the enclosures protecting safety-related equipment from spray originating from the nonsafety-related components inside are included within the scope of license renewal under 10 CFR 54.4(a)(2) and are evaluated in LRA Section 2.4.13. The staff's concern described in RAI 2.3.3.17-3 is resolved.

In RAI 2.3.3.17-4, dated November 24, 2008, the staff noted that in the following instances, the applicant shows the same components highlighted in different colors on different license renewal drawings, reflecting the components being included in the scope of license renewal for different reasons:

- On license renewal drawing LR-302-181, components CE10 through CE16 and their associated piping are shown highlighted in red; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(2) criteria. However, on license renewal drawings LR-302-111 and LR-302-011, these same components and their associated piping are shown highlighted in green; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(1) or (a)(3) criteria.

- On license renewal drawing LR-302-182, components CE17, CE18, CE25 through CE27 and their associated piping are shown highlighted in red; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(1) or (a)(3) criteria. However, these same components and their associated piping, CE17 and CE18 (license renewal drawing LR-302-111), CE25 (license renewal drawing LR-302-101) and CE26 and CE 27 (license renewal drawing LR-302-101), are shown highlighted in green; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(2) criteria.

- On license renewal drawing LR-302-671, components CE118, CE119 and their associated piping, are shown in black; indicating that they are not within the scope of license renewal. However, on license renewal drawing LR-302-640, these same components and their associated piping are shown highlighted in red; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(2) criteria.

- On license renewal drawing LR-302-671, components CE100 through CE106 and their associated piping are shown highlighted in red; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(2) criteria. However, these same components and their associated piping, CE100 through CE104 (license renewal drawing LR-302-719), CE104 (license renewal drawing LR-302-660), and CE105 and CE106 (license renewal drawing LR-302-650), are shown highlighted in green; indicating that they are within the scope of license renewal for 10 CFR 54.4(a)(1) or (a)(3) criteria.

Proper identification of components included within the scope of license renewal is necessary to properly identify the intended function and whether additional attached or surrounding equipment needs to be included within the scope of license renewal to support or protect the ability of a safety-related component to perform its safety function. For the components and their associated piping described above, the staff requested the applicant provide additional information to clarify which criteria the components are in scope under 10 CFR 54.4(a) and determine whether additional components are necessary to be brought within the scope of license renewal as a result.

In its response to the RAI, dated December 5, 2008, the applicant stated that that CE10 through CE16 and their associated piping are nonsafety-related components that are in scope for 10 CFR 54.4(a)(2) criteria (functional support) and that these components should have been shown in green, but were incorrectly depicted on license renewal drawing LR-302-181 in red. The applicant then explained the extent of the red highlighting on LR-302-181 which should have been shown in green. In conclusion the applicant stated that no additional components were required to be brought within the scope of license renewal due to the incorrect highlighting.

The applicant also stated that CE17, CE18, and CE25 through CE27 and their associated piping are nonsafety-related components that are in scope for 10 CFR 54.4(a)(2) criteria (spatial interaction) and that these components should have been shown in red, but were incorrectly depicted on license renewal drawings LR-302-101 and LR-302-111 in green. The applicant then explained the extent of the green highlighting on the two license renewal drawings which should have been shown in red. In conclusion the applicant stated that no additional components were required to be brought within the scope of license renewal due to the incorrect highlighting.

The applicant also stated that on license renewal drawing LR-302-640, CE118 and CE119 should have been shown in black to match their representations on LR-302-671, which are correctly shown as not in scope for 10 CFR 54.4(a)(2)(spatial interaction) because they are located inside a shielded sample panel. The applicant stated that the piping up to CE118 and CE119 on license renewal drawing LR-302-640 is correctly shown in red to indicate its inclusion in scope for 10 CFR 54.4(a)(2) criteria (spatial interaction) up to the shielded sample panel. In conclusion the applicant stated that no additional components were required to be brought within the scope of license renewal due to the incorrect highlighting.

The applicant also stated that CE100 through CE106 and their associated piping are nonsafety-related components that are in scope for 10 CFR 54.4(a)(2) criteria (functional support) and should be shown in green, but were incorrectly depicted on license renewal drawing LR-302-671 in red. The applicant stated that CE100 through CE106 and their scoping boundaries are correctly depicted in green on the other license renewal drawings referenced in the RAI. In conclusion the applicant stated that no additional components were required to be brought within the scope of license renewal due to the incorrect highlighting.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.17-4 acceptable because the applicant clarified which components were required to be scope for license renewal and subject to an AMR, and no additional components were required to be brought within the scope of license renewal. The staff’s concerns described in RAI 2.3.3.17-4 are resolved.

In RAI 2.3.3.17-5, dated November 24, 2008, the staff noted that on license renewal drawing LR-302-671, the piping leading up to and the valves CA-V99B, CA-V99A, CA-V95 and CA-V109 are shown in black; indicating that they are not within the scope of license renewal. However, these piping segments connect directly to various 3/8 inch piping shown highlighted in red; indicating that these other various piping segments are within the scope of license renewal for 10 CFR 54.4(a)(2) criteria. Since there is no apparent physical barrier and the piping is directly attached to other piping that is included in the scope of license renewal under 10 CFR 54.4(a)(2), then this piping and valves should also be included in the scope of license renewal. The staff requested the applicant provide additional information to justify the exclusion of the piping and valves from the scope of license renewal and subject to AMR with the intended function of leakage boundary.

In its response to the RAI, dated December 5, 2008, the applicant stated that the LGS system scoping boundary, which includes potentially liquid filled lines outside of sample hoods and shielded sample panels, is incorrectly shown on license renewal drawing LR-302-671. The applicant stated that the system scoping boundary includes the piping to valves CA-V95, CA-V99A, CA-V99B and CA-V109 and continues through four additional valves to the associated 3/8 inch piping that is physically located outside the sample hood and ends at the LGS system to miscellaneous floor and equipment drains system boundary flag. The applicant discussed additional valves, piping and tubing runs shown on license renewal drawing LR-302-671, which also should have been highlighted as within the scope of license renewal. In conclusion, the applicant stated that the components discussed in the response should have been highlighted in red, indicating they are in the scope of license renewal for 10 CFR 54.4(a)(2) criteria (spatial interaction).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.17-5 acceptable because the applicant clarified that the piping and valves identified in the RAI should have been included in the scope of license renewal for 10 CFR 54.4(a)(2) criteria with an intended function of spatial interaction. The staff’s concern described in RAI 2.3.3.17-5 is resolved.

In RAI 2.3.3.17-6, dated November 24, 2008, the staff noted that on license renewal drawing LR-302-671 the applicant shows valves CA-V32A, CA-V32B, CA-V337, CA-V47, CA-V48, CA-V53, CA-V59, CA-V61, CA-V64A, CA-V67A, CA-V64B, CA-67B, CA-V70, CA-V73, CA-V78, CA-V75, CA-V82A, CA-V82B, CA-V80, CA-V85A, and CA-V85B in black; indicating that they are not within the scope of license renewal. However, immediately before these valves, the piping is shown highlighted in red; indicating that the piping is within the scope of license renewal for 10 CFR 54.4(a)(2) criteria with an intended function of leakage boundary. There must be a method of isolating the piping components that are within the scope of license renewal for leakage boundary from the piping components that are not within scope. This isolation can be achieved by a valve, which can be closed and is within scope, or by a physical barrier. The staff requested the applicant provide additional information to justify the exclusion of the listed valves from the scope of license renewal and subject to aging management for an intended function of leakage boundary.

In its response to the RAI, dated December 5, 2008, the applicant stated that valves CA-V32A and CA-V32B, OTSG sample coolers CA-C-2A and CA-C-2B, valves CA-V51A and CA-V51B, and associated piping to the sample hood wall downstream, are nonsafety-related components that perform a leakage boundary intended function within the scope of license renewal for 10 CFR 54.4(a)(2) criteria and should be shown in red instead of black on license renewal drawing LR-302-671. The applicant also stated the OTSG sample coolers are evaluated for license renewal in the CCCW system as “Heat exchanger components (Pressurizer Sample and OTSG Sample Coolers)” in LRA Tables 2.3.3-4 and 3.3.2.4. Note 2 on LR-302-671 should have included the CCCW system.

The applicant also stated that CA-V337 is a nonsafety-related, normally closed valve that performs a leakage boundary intended function within the scope of license renewal for 10 CFR 54.4(a)(2) criteria and should be shown in red instead of black on license renewal drawing LR-302-671. The applicant stated that the piping downstream of CA-V337 is nonsafety-related, not liquid filled and performs no intended function; therefore, it is not within scope of license renewal.

The applicant also stated that CA-V47, CA-V48, CA-V1070, CA2P1, and associated tubing are nonsafety-related, gas filled components and that the valves and associated tubing are not in scope because they are not relied upon to perform a structural support intended function and there is no potential for spatial interaction with safety-related components. The applicant stated that these valves and their associated tubing should have been depicted in black on license renewal drawing LR-302-671, indicating that these components do not perform any intended function and are not in scope for license renewal.

The applicant also stated that valves CA-V53, CA-V59, CA-V61, CA-V64A, CA-V67A, CA-V64B, CA-67B, CA-V70, CA-V73, CA-V78, CA-V75, CA-V82A, CA-V82B, CA-V80, CA-V85A, CA-V85B and associated piping are nonsafety-related components that are in the scope of license renewal for 10 CFR 54.4(a)(2) criteria (spatial interaction) and that these components perform a leakage boundary intended function up to the sample hood wall and should be shown in red instead of black on license renewal drawing LR-302-671.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.17-6 acceptable because the applicant clarified which valves and associated components identified in the RAI should have been in scope and subject to an AMR. The staff’s concerns described in RAI 2.3.3.17-6 are resolved.

2.3.3.17.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the liquid and gas sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.18 Miscellaneous Floor and Equipment Drains System

2.3.3.18.1 Summary of Technical Information in the Application

LRA Section 2.3.3.18 describes the miscellaneous floor and equipment drains (MFED) system which consists of the following plant systems: steam generator secondary side blowdown and drains system, sumps and waste collection, turbine building sumps and drains system, auxiliary building sump and drain system, intermediate building sump, circulating water pumphouse sump, air intake tunnel sump, and miscellaneous sumps and drains. The MFED system is an auxiliary system designed to provide drainage control and management to the plant.
The purpose of the MFED system is to provide drainage control and management to plant buildings and rooms, provide flood protection to equipment, and provide a flowpath for OTSG sample blowdown to the main condenser. The MFED system accomplishes this by providing

drains, drain flowpaths, sumps, sump pumps, and discharge flowpaths from buildings and rooms. LRA Table 2.3.3-18 identifies the components subject to aging management review for the miscellaneous floor and equipment drain system by component type and intended function.

2.3.3.18.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the MFED system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.19 Open Cycle Cooling Water System

2.3.3.19.1 Summary of Technical Information in the Application

LRA Section 2.3.3.19 describes the OCCW system which consists of the mechanical draft cooling towers, nuclear service river water system, secondary services cooling water system, decay heat river system, screen wash and sluice system, screen house ventilation system, and river water pump lubrication system. The OCCW system is an auxiliary system designed to provide cooling water from the Susquehanna River to several plant components.

The purpose of the OCCW system is to circulate cooling water from the river through both safety-related and nonsafety-related heat exchangers and back to the river. The OCCW system accomplishes this by providing screened river water to the river water pump suctions and then circulating river water through the nuclear service closed cooling water heat exchangers, intermediate service closed cooling water coolers, decay heat service coolers, secondary services heat exchangers, and screen house ventilation equipment.

The nuclear service river water, secondary services cooling water, screen wash and sluice, screen house ventilation, and river water pump lubrication systems are normally in operation. The decay heat river system is normally in operation during plant shutdown and is used part time during normal plant operation to augment the dilution of plant effluents. The decay heat river system will actuate automatically upon receipt of an engineered safeguards actuation signal and operate in the same way as for normal operation. Nuclear services river water will receive an automatic start signal when the engineered safeguards system actuates. During a loss of nuclear services river water, a cross connection with secondary services cooling water, requiring manual operator action, can provide cooling to the nuclear services river water heat loads.

LRA Table 2.3.3-19 identifies the components subject to an AMR for the OCCW system by component type and intended function.

2.3.3.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.19 and UFSAR Sections 9.6.1, 9.6.2, and 9.8.8.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.19 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.
In RAI 2.3.3.19-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-203 the traveling water screens and automatic bar rakes are highlighted in green, indicating that they are within the scope of license renewal. The traveling water screens and debris bars (bar racks, not the automatic rakes) have a passive intended function of filter. On LRA page 2.3-139 in the last paragraph, the applicant stated that the OCCWS boundary begins at the intake screen and pump house bar racks. The staff noted that traveling water screens and debris bars have not been listed in LRA Table 2.3.3-19. The staff did not find the traveling water screens and debris bars included in LRA Section 2.4.8, Intake Screen and Pump House. The staff requested that the applicant provide additional information to justify the exclusion of the bar racks and traveling screens from the intended function of filter from LRA Table 2.3.3-19.

In its response to the RAI, dated September 16, 2008, the applicant stated that the bar racks are passive components within the scope of license renewal with an intended function of filter. The applicant further stated that the bar racks are subject to an AMR and should have been included in LRA Table 2.3.3-19. The applicant further stated that there are bar grids, located at the outer most portion of the intake structure beyond the bar racks, that function to prevent large debris from entering the intake. The bar grids are also within the scope of license renewal with an intended function of filter, similar to the bar racks; however, the bar grids are not shown on license renewal drawing LR-302-203. The applicant explained that the traveling screens are also within the scope of license renewal with a filter intended function, but are active components and not subject to an AMR.

The applicant amended the LRA by adding the component "Strainer Element (ISPH Bar Grids, ISPH Bar Racks)" with an intended function of filter to LRA Table 2.3.3-19 and by adding the same component type to LRA Table 3.3.2-19 with complete AMR results. In addition, the applicant amended the aging management programs list in LRA Section 3.3.2.1.19 to add AMP: "Structures Monitoring." The applicant also provided amended text for subsections System Operation, System Boundary, and System Intended Functions to LRA Section 2.3.3.19 for the OCCWS. The amended text reflected the addition of the bar grids and bar racks to components subject to an AMR for the system.

On October 23, 2008, the staff conducted a conference call with the applicant to discuss their response to RAI 2.3.3.19-1. As a result of the teleconference, the applicant clarified that the correct dimensions of the bar grids is a 2-foot horizontal spacing and a 3.5-foot vertical spacing. Additionally, the applicant indicated that in the next to last paragraph on page 31 of 44 of its letter dated September 16, 2008, the word "in" was missing between the words "included" and "the." The sentence should read: "included in the OCCW System." Additionally, the applicant stated that for the strainer element bar grids and bar racks in revised Table 3.3.2.19 (see page 33 of 41 of September 16, 2008, letter) the word "internal" is incorrect and that the correct environment is "raw water external." The staff questioned whether the discussion section should be revised for Item 3.3.1- 79 in Table 3.3.1 based on the response to the RAI (see page 33 of 44 of September 16, 2008, letter). The applicant indicated that the discussion section for Item 3.3.1-79 in Table 3.3.1 would be revised to reflect the structures monitoring program. The staff concurred with the applicant's proposed resolutions to the minor errors noted above.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.19-1 acceptable because the applicant added the intake structure's bar racks and bar grids to the scope of license renewal and identified them as subject to an AMR. The applicant added component "Strainer Element (ISPH Bar Grids, ISPH Bar Racks)" with an intended function of filter to LRA Tables 2.3.3-19 and 3.3.2-19. In addition, the applicant amended LRA Section 3.3.2.1.19 to add "Structures Monitoring" to the aging management programs list, and amended LRA Section 2.3.3.19 to address the addition of these components within the scope of license renewal. The staff's concern described in RAI 2.3.3.19-1 is resolved.

In RAI 2.3.3.19-2, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-202 there are two restricting orifices highlighted in red, indicating that they are within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria; however, LRA Table 2.3.3-19 shows restricting orifices with a pressure boundary function only, indicting they are in scope based on 10 CFR 54.4(a)(1) or (a)(3) criteria. The appropriate function for (a)(2) components would be leakage boundary, but the components are not included in LRA Table 2.3.3-19 for restricting orifices. The staff requested that the applicant provide additional information to justify the exclusion of the leakage boundary function for the restricting orifices from LRA Table 2.3.3-19.

In its response to the RAI, dated September 16, 2008, the applicant stated the restricting orifices in the OCCWS perform both pressure and leakage boundary functions; however, the leakage boundary function was omitted from LRA Tables 2.3.3-19 and 3.3.2-19. The applicant amended the LRA by adding the intended function of leakage boundary to the component restricting orifices in LRA Tables 2.3.3-19 and 3.3.2-19 with complete aging management review results.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.19-2 acceptable because the applicant added the intended function "leakage boundary" for the component type restricting orifices to LRA Tables 2.3.3-19 and 3.3.2-19. The staff's concern described in RAI 2.3.3.19-2 is resolved.

In RAI 2.3.3.19-3, dated November 24, 2008, the staff noted that on river water system license renewal drawing LR-302-202, a six-inch pipe is highlighted in red, indicating that the piping is within the scope of license renewal. The piping is shown to continue onto plant drawing 302-161 to a "Clarifier." However, the continuation arrow is not highlighted, indicating the downstream components were not included in the scope of license renewal, and continuation drawing 302-161 has not been provided. The staff needs to review the structures and components on this continuation drawing to verify that the applicant has properly included the components in scope and subject to an AMR as required by 10 CFR 54.21. The staff requested the applicant provide additional information for continuation drawing 302-161 identifying the structures and components within the scope of license renewal and subject to an AMR, or provide a basis for the exclusion of the structures and components on this drawing.

In its response to the RAI, dated December 5, 2008, the applicant stated that the 30-inch diameter piping from the discharge header of the secondary services pumps on license renewal drawing LR-302-202 runs underground to the heat exchanger vault located in the auxiliary building and that the 30-inch pipe is in scope for license renewal for 10 CFR 54.4(a)(2) criteria because it provides structural support to attached safety-related piping. The applicant stated that the attached six-inch branch piping is also buried and connects the 30-inch header to the clarifier located in the pretreatment building and that the branch six-inch piping and the clarifier do not perform an intended function required to be included in the scope of license renewal. The applicant stated that the six-inch branch piping from the 30-inch header should have been colored black on license renewal drawing LR-302-202 to indicate that it is not in scope of license renewal.

The applicant stated that components shown on continuation drawing 302-161 are also not included in the scope of license renewal.

Based on its review, the staff found the applicant's response to RAI 2.3.3.19-3 acceptable because the applicant clarified that the six-inch branch piping and the clarifier do not perform an intended function for license renewal and should have been colored black. The staff's concern described in RAI 2.3.3.19-3 is resolved.

2.3.3.19.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the OCCW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.20 Radiation Monitoring System

2.3.3.20.1 Summary of Technical Information in the Application

LRA Section 2.3.3.20 describes the radiation monitoring (RM) system which consists of the following plant systems: radiation monitoring and sampling system and post accident monitoring system. The RM system is an auxiliary system designed to detect, indicate, annunciate, and record radiation levels at selected locations inside and outside the plant. It also provides interlock signals to support intended functions on high radiation level detection. The RM system accomplishes this through area, atmospheric, and liquid radiation monitors.

Area monitoring consists of twenty-four channels which perform personnel, process, and effluent monitoring functions. Area monitors are single, self-contained detector units with no associated sampling or detection piping and components. Area monitors detect radiation levels inside the reactor building, auxiliary building, control tower, and fuel handling building. RM-G-9 fuel handling building area monitor is nonsafety-related and provides an isolation signal for the fuel handling building ventilation system. Area monitors also monitor once through steam generators, reactor coolant, reactor coolant pump seal return, and reactor coolant drain tank pump discharge. RM-G-9 is a nonsafety-related area monitor that supports an intended function of isolating the fuel handling building ventilation system. It provides an interlock signal on high radiation level indication. The other area monitors do not support intended functions and their failure would not prevent safety-related components or systems from performing their intended functions.

Atmospheric monitoring consists of fifteen channels which provide effluent monitoring, emergency release monitoring, and in-plant air monitoring. Channels are located inside and outside the plant. Atmospheric monitors detect radiation levels in the control tower air intake, reactor building air sample line, fuel handling building exhaust ventilation duct, condenser vacuum pump exhaust, waste gas discharge, auxiliary and fuel handling building exhaust, reactor building purge exhaust, radiochemical laboratory, fuel handling building emergency safety features ventilation system exhaust, chemical cleaning building ventilation exhaust, waste handling and packing facility exhaust, and the respirator cleaning and laundry maintenance (RLM) facility exhaust.

Atmospheric monitors have associated sampling and detection piping and components. The control tower air intake channel (RM-A1) is nonsafety-related and supports an intended function of maintaining control room habitability by placing the control room ventilation system in recirculation mode. The fuel handling building exhaust ventilation duct channel (RM-A-4) and the reactor building purge exhaust channel (RM-A-9) are nonsafety-related and sense process conditions and generate signals to isolate ventilation systems. The fuel handling building ESF ventilation system exhaust channel (RM-A-14) is nonsafety-related and supports and intended function of removing radioactive material from the atmosphere of confined spaces outside primary containment by isolating the ventilation system. The other atmospheric monitors do not support intended functions and their failure would not prevent safety-related components or systems from performing their intended functions. Liquid monitoring consists of nine liquid monitors which provide effluent monitoring, leak detection, and monitoring of the reactor coolant system activity. Liquid monitors detect radiation levels of closed cooling loops, spent fuel pool water, reactor coolant letdown, liquid wastewater prior to dilution by the mechanical draft cooling tower basin, discharge to the river, and industrial waste treatment discharge.

Liquid monitors and associated sampling and detection piping and components are not included in the scope of this system and are evaluated with the license renewal system associated with the process fluid (i.e., closed cycle cooling water system, makeup and purification system, and spent fuel cooling system). Post-accident radiation monitoring consists of high-range effluent monitors for extended ranges to area radiation monitors and high-range containment radiation monitors to monitor containment radiation levels during and following a postulated accident. The high range containment radiation monitors perform an intended function and are in the scope of license renewal.

LRA Table 2.3.3-20 identifies the components subject to an AMR for the RM system by component type and intended function.

2.3.3.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20 and UFSAR Sections 4.2.3.8, 5.3.2, 7.3.2.2, 7.4.2.1, 9.1.2, 9.2.2.5, 9.3.2.5, 9.4.6, 9.6.2.1, 9.8.1.5, 9.8.2, 9.8.3, 10.3.3.2, 11.2.1.3, 11.4, and 14.2.2.1 as well as LRA Tables 7.3 2 and 7.3-3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.20 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.
In RAI 2.3.3.20-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-833, sheet 1, an isokinetic nozzle (REA14) is highlighted in green, indicating it is within the scope of license renewal for 10 CFR 54.4(a)(1). The nozzle is associated with the radiation monitor RM-A14 and has an intended function of pressure boundary and direct flow. LRA Table 2.3.3-20 does not show the nozzle as a component with an intended function of pressure boundary or direct flow. The staff requested that the applicant provide additional information to justify the exclusion of the isokinetic nozzle from LRA Table 2.3.3-20.

In its response to the RAI, dated September 16, 2008, the applicant stated that the isokinetic nozzle highlighted in green on license renewal drawing LR-302-833, is in the scope of license renewal with intended functions of direct flow and pressure boundary; however, it was omitted from LRA Tables 2.3.3-20 and 3.3.2-20. Also in its response, the applicant amended the LRA by adding the component “Nozzle (Isokinetic Nozzle)” with an intended function of direct flow and pressure boundary to LRA Tables 2.3.3-20 and 3.3.2-20 with complete AMR results.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.20-1 acceptable because the applicant added the component “Nozzle (Isokinetic Nozzle)” with intended functions of direct flow and pressure boundary to LRA Tables 2.3.3-20 and 3.3.2-20. The staff’s concern described in RAI 2.3.3.20-1 is resolved.

2.3.3.20.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the radiation monitoring system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.21 Radwaste System

2.3.3.21.1 Summary of Technical Information in the Application

LRA Section 2.3.3.21 describes the radwaste system as a normally operating liquid, solid, and gaseous radioactive waste management system. The radwaste system consists of several plant systems including the gaseous waste disposal system, the liquid radwaste disposal system, the solid radwaste disposal system, the processed water system, and the incore detector disposal system.

The purpose of the radwaste system is to manage radioactive waste produced as a result of plant operation. The radwaste system accomplishes this by collecting, processing, and preparing for disposal, potentially radioactive liquid, gaseous, and solid wastes. The radwaste system is designed and constructed to meet or exceed the applicable federal regulations for the containment, control, and release or disposal of radioactive liquids, gases, and solids generated as a result of normal and emergency operation of the plant.

The radwaste system includes reactor building isolation valves and piping to assure that radioactive material is not inadvertently transferred out of the reactor building, and, it includes valves for, or associated with, flowpaths required for safe shutdown. The radwaste system collects, contains, and suppresses steam relief from the RCS pressurizer PORV and code safety valves. LRA Table 2.3.3-21 identifies the components subject to an AMR for the radwaste system by component type and intended function.

2.3.3.21.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the radwaste system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.22 Service Building Chilled Water System

2.3.3.22.1 Summary of Technical Information in the Application

LRA Section 2.3.3.22 describes the service building chilled water (SBCW) system. The purpose of the SBCW for license renewal is to maintain leakage boundary integrity to preclude system interactions. For this reason, this system's pressure retaining components located in proximity to other components performing safety-related functions have been included in the scope of license renewal.

The purpose of the service building chilled water system is to provide heat removal for the service building ventilation, which is not in scope for license renewal. The service building chilled water system accomplishes this by supplying cooling water for the service building air handling units. The system is normally in operation.

The intended function of the service building chilled water system within the scope of license renewal is to resist nonsafety-related SSC failure.

LRA Table 2.3.3-22 identifies the components subject to an AMR for the service building chilled water system by component type and intended function.

2.3.3.22.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.22 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.22 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.22-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-846, level indicator LI-1007 is highlighted in red, indicating that it is within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria. This component type typically includes a sight glass, which would have a leakage boundary function. Sight glass is not listed in LRA Tables 2.3.3-22 and 3.3.2-22 as a component type with a leakage boundary function. The staff requested that the applicant provide additional information to justify the exclusion of the sight glass from LRA Tables 2.3.3-22 and 3.3.2-22.

In its response to the RAI, dated September 16, 2008, the applicant stated that the sight glass, LI-1007, shown in red on license renewal drawing LR-302-846, is in the scope of license renewal with an intended function of leakage boundary; however, it was omitted from LRA Tables 2.3.3-22 and 3.3.2-22. The applicant amended the LRA by adding the component "sight glass" with an intended function of leakage boundary to LRA Tables 2.3.3-22 and 3.3.2-22 with complete AMR results, and adding the material "glass" to LRA Section 3.3.2.1.22.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.22-1 acceptable because the applicant added the component “sight glass” with an intended function of leakage boundary to LRA Tables 2.3.3-22 and 3.3.2-22, and added the material “glass” to LRA Section 3.3.2.1.22. The staff’s concern described in RAI 2.3.3.22-1 is resolved.

2.3.3.22.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the service building chilled water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.23 Spent Fuel Cooling System

2.3.3.23.1 Summary of Technical Information in the Application

LRA Section 2.3.3.23 describes the spent fuel cooling (SFC) system which is a mechanical, safety-related, normally operating system designed to remove decay heat from the spent fuel stored in the spent fuel pools. The SFC system is capable of maintaining spent fuel pool temperatures within design limits. The purpose of the SFC system is to remove decay heat from the spent fuel stored in the pools. The SFC system accomplishes this by forced circulation of spent fuel pool water through coolers. The SFC system operation is initiated by manual control for spent fuel cooling functions. Secondary functions are controlled via local manipulation of valves and control equipment. LRA Table 2.3.3-23 identifies the components subject to an AMR for the SFC system by component type and intended function.

2.3.3.23.2 Conclusion

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

2.3.3.24 Station Blackout and UPS Diesel Generator System

2.3.3.24.1 Summary of Technical Information in the Application

LRA Section 2.3.3.24 describes the SBO and uninterruptible power supply (UPS) diesel generator systems which consist of the following plant systems: SBO diesel and support systems (mechanical) and UPS diesel (mechanical). The SBO system is an auxiliary system designed to supply electrical power to key plant components during a SBO event. These include the mechanical portions of the UPS diesel system. Only electrical components of the UPS are required to perform an intended function, which is to provide power to trip signals during an ATWS event. Those electrical components are evaluated with the 120 V vital power systems.

The SBO system is a mechanical system designed to provide the motive force for generating electrical power for key plant components during a SBO event. The SBO system accomplishes this by utilizing diesel engines to rotate electric generators attached to the diesel engines. Fuel supply, air supply, and cooling water support SBO diesel engine operation. LRA Table 2.3.3-24 identifies the components subject to an AMR for the SBO and UPS diesel generator systems by component type and intended function.

2.3.3.24.2 Conclusion

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

2.3.3.25 Water Treatment and Distribution System

2.3.3.25.1 Summary of Technical Information in the Application

LRA Section 2.3.3.25 describes the water treatment and distribution (WTD) system which consists of the following plant systems: water pretreatment system, cycle makeup demineralizer system, demineralized water system, domestic water system, reclaimed water system, filtered water system, river water biocide system, and domestic plumbing and drainage systems.

The purpose of the WTD system is to provide storage and supply of domestic, demineralized, filtered, and well water for various uses throughout the site. The WTD system accomplishes this by utilizing filters, demineralizers, tanks, piping, and pumps to store, process, and transfer the water to the end-use systems.

LRA Table 2.3.3-25 identifies the components subject to an AMR for the WTD system by component type and intended function.

2.3.3.25.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.25 and UFSAR Sections 9.2.1, 9.6.1, 10.4.1, 10.4.2, 11.2, and LRA Table 5.3-2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.25 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.
In RAI 2.3.3.25-1, dated August 20, 2008, staff noted that on license renewal drawing LR-302-162 a vacuum degasifier tank is highlighted in red, indicating that it is within the scope of license renewal based on 10 CFR 54.4(a)(2) criteria. This component type should have a leakage boundary function. LRA Table 2.3.3-25 includes tank as a component type and itemizes which tanks are included. However, the table does not show the vacuum degasifier tank as a component subject to an AMR. The staff requested that the applicant provide additional information to justify the exclusion of the vacuum degasifier tank from LRA Table 2.3.3-25.

In its response to the RAI, dated September 16, 2008, the applicant stated that the license renewal drawing LR-302-162 highlighting is correct showing the vacuum degasifier tank in the scope of license renewal with an intended function of leakage boundary; however, this tank was omitted from LRA Tables 2.3.3-25 and 3.3.2-25. The applicant also stated the degasifier booster pumps highlighted on license renewal drawing LR-302-162 are within the scope of license renewal and have an intended function of leakage boundary, but the pumps were also omitted from LRA Tables 2.3.3-25 and 3.3.2-25. The applicant amended the LRA by adding the components "Pump Casing (Degasifier Booster Pumps)" and "Tanks (Vacuum Degasifier Tank)" with intended functions of leakage boundary to LRA Tables 2.3.3-25 and 3.3.2-25 with complete AMR results.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.25-1 acceptable because the applicant added the component "Pump Casing (Degasifier Booster Pumps)" and "Tanks (Vacuum Degasifier Tank)" to LRA Tables 2.3.3-25 and 3.3.2-25. The staff's concern described in RAI 2.3.3.25-1 is resolved.

2.3.3.25.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the water treatment and distribution system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

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

- Condensate System
- Condensers and Air Removal System
- Emergency Feedwater System
- Extraction Steam System
- Feedwater System
- Main Generator and Auxiliary Systems
- Main Steam System
- Steam Turbine and Auxiliary Systems

2.3.4.1 Condensate System

2.3.4.1.1 Summary of Technical Information in the Application

LRA Section 2.3.4.1 describes the condensate system which is a normally operating secondary side water system that consists of the following plant systems: main condensate system, powdex condensate polishing system, condensate seal water system, and condensate chemical feed system. The condensate system has several interfaces with other systems that are not within the license renewal boundary of the condensate system.

The purpose of the condensate system is to deliver water to the main and emergency feedwater pumps. During normal plant conditions the condensate system delivers deaerated water from the main condenser hotwell to the suction header of the feedwater system, such that the net positive suction head requirements of the main feedwater pumps and the water purity requirements of the OTSGs are met. During abnormal conditions the condensate system provides water to the emergency feedwater pumps from condensate storage tanks, the primary water supply for these pumps. The main condenser hotwell can also be aligned to the suction of the emergency feedwater pumps as an alternate water supply. The condensate system design provides alternate flow paths from each of these water sources to the emergency feedwater pumps, satisfying requirements for plant safe shutdown during a fire.

During a station blackout event, the inventory of the condensate storage tanks is used for decay heat removal. The condensate system includes the powdex condensate polishers that function to establish and maintain the required quality of the feedwater delivered to the OTSGs. The seal water function of the condensate system prevents air from entering the main condenser by placing a water seal on valves and pumps subject to condenser vacuum. Due to its interfaces with the main condenser, the condensate system itself functions as part of the pressure boundary for main condenser vacuum. The condensate system also provides chemical treatment of secondary side water to maintain feedwater pH, feedwater oxygen, and second stage high pressure heater pH within design limits. Additionally, the condensate system serves as a water supply to condenser expansion joints, turbine exhaust hood spray, reactor coolant bleed tanks, and the CCCW System.

LRA Table 2.3.4-1 identifies the components subject to an AMR for the condensate system by component type and intended function.

2.3.4.1.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the condensate system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.2 Condensers and Air Removal System

2.3.4.2.1 Summary of Technical Information in the Application

LRA Section 2.3.4.2 describes the condensers & air removal system which is a normally operating system designed primarily to condense and deaerate steam from the main turbine and the main feedwater pump turbines. The condensers & air removal system consists of several plant systems including the main condenser, main condenser air removal system, auxiliary condensers, and auxiliary condensers air removal system.

The purpose of the main condenser and auxiliary condenser portions of the system is to recover water used in the steam cycle by condensing and deaerating unused steam. The system accomplishes this by transferring heat to the circulating water system (which is within the tube bundle of the condensers), collecting the condensate, and storing the condensate in the hotwell for reuse in the steam cycle.

The purpose of the main condenser and auxiliary condenser air removal portions of the system is to allow the main condenser and auxiliary condensers to operate at vacuum for peak efficiency. It accomplishes this by removing air and non-condensables from the main and auxiliary condensers using vacuum pumps during operation of the main turbine and main feedwater pump turbines.

The condensers and air removal system is credited for gas-to-liquid iodine partitioning for the steam generator tube failure accident and the rod ejection accident. In abnormal operating conditions, the hotwell portion of the condensers and air removal system provides a backup source of water for emergency feedwater system operation. LRA Table 2.3.4-2 identifies the components subject to aging management review for the condensers and air removal system by component type and intended function.

2.3.4.2.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the condensers and air removal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an aging management review in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.3 Emergency Feedwater System

2.3.4.3.1 Summary of Technical Information in the Application

LRA Section 2.3.4.3 describes the emergency feedwater system which is a standby system designed to remove heat from the primary system when the normal feedwater supply is not available. The emergency feedwater system is capable of holding the plant at hot standby and is also capable of cooling down the plant to the point at which the normal decay heat removal system can operate.

The system is not required for plant start-up, normal plant operations or normal shutdown. The system is used only during emergency conditions and periodic testing. The purpose of the emergency feedwater system is to remove heat (including reactor coolant pump energy, decay and sensible heat) from the reactor coolant system to allow safe shutdown of the reactor when the feedwater system is not available. The emergency feedwater system accomplishes this by delivering water to the OTSGs from various water sources.

The emergency feedwater system operation is initiated automatically on loss of both main feedwater system pumps, loss of all four reactor coolant pumps, low OTSG water level, high containment pressure, or, it can be initiated manually. The emergency feedwater system will automatically control feedwater flow to maintain water level in the OTSGs. The water level setpoint is based on the status of the reactor coolant pumps. OTSG water levels are maintained higher when all reactor coolant pumps are off to promote natural circulation in the reactor coolant system. Manual control of the emergency feedwater flow to each of the OTSGs is also available to the operator in the main control room.

The emergency feedwater system is designed so that a single failure will not result in the loss of emergency feedwater system function during a LOCA or during a loss of offsite power. The emergency feedwater system is capable of providing emergency feedwater flow to the OTSGs for at least two hours without relying on alternating current (AC) power.

LRA Table 2.3.4-3 identifies the components subject to an AMR for the emergency feedwater system by component type and intended function.

2.3.4.3.2 Staff Evaluation

The staff's review of LRA Section 2.3.4.3 and UFSAR Sections 1.3.2.20, 1.3.2.21, 4.2.5.4, 5.3, 7.1.4, 7.3.2.2.c.16, 9.8.6, 9.10.3, 10.6 and 14.0 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.4.3-1, dated November 24, 2008, the staff noted that on license renewal drawing LR-302-082 the safety-related emergency feedwater control valves to the steam generators are shown within the scope of license renewal. However, the air operators for these valves are not highlighted, indicating the operators are not within the scope of license renewal. In LRA Section 2.3.4.3 the applicant states that these valves will initially fail closed with loss of air supply to reduce the potential for severe overcooling transients, but that there is adequate time available to the operator to take action to open a flow control valve and restore flow should the flow control valves fail closed. There are multiple sources of air available to ensure their proper positioning during a design basis event in accordance with 10 CFR 54.4(a)(1). License renewal drawing LR-302-273 for the instrument air system shows the instrument air supply up to these emergency feedwater control valves highlighted in green, indicating they are within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) and/or (a)(3).

The emergency feedwater control valves' air operators perform a function to change position to regulate flow during a DBE, which would require them to be included within the scope of license renewal under 10 CFR 54.4(a). Even though the operator is an active component, the valve body is passive and requires an AMR in accordance with 10 CFR 54.21. The staff requested that the applicant provide additional information to justify the exclusion of the emergency feedwater control valves' air operators from the scope of license renewal and AMR.

In its response to the RAI, dated December 5, 2008, the applicant stated that the air operators for the emergency feedwater system control valves EF-V30A, EF-V30B, EF-V30C, and EF-V30D on license renewal drawing LR-302-082 are not excluded from the scope of license renewal. The applicant stated that on scoping boundary drawings LR-302-032 and LR-302-273 the control valve air operators and their air supplies are properly shown in the scope of license renewal for 10 CFR 54.4(a)(1) criteria and that the four air operator symbols for the four control valves on LR-302-082 should have been colored green as in scope for 10 CFR 54.4(a)(1); however, as active components the control valve air operators are not subject to aging management review.

Based on its review, the staff found the applicant's response to RAI 2.3.4.3-1 acceptable because the applicant clarified emergency feedwater system control valves are not excluded from the scope of license renewal, and should have been colored green as in scope for 10 CFR 54.4(a)(1) criteria. The staff's concern described in RAI 2.3.4.3-1 is resolved.

2.3.4.3.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the emergency feedwater system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an aging management review in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.4 Extraction Steam System

2.3.4.4.1 Summary of Technical Information in the Application

LRA Section 2.3.4.4 describes the extraction steam system which consists of the following plant systems: extraction steam (high pressure & low pressure) system, feedwater heater drains system, and the feedwater heater vents, reliefs, and miscellaneous drains system.

The extraction steam system is a normally operating system designed to deliver steam from the high and low pressure sections of the main turbine to secondary side plant components. Steam is delivered to the feedwater heaters for feedwater preheating, which improves overall plant efficiency. Steam is also delivered to the following components to support their process functions: main feedwater pump turbines, radioactive waste evaporators, auxiliary boilers, and the caustic solution heater used for mixed bed regeneration.

The extraction steam system includes the heater drain pumps, which return condensed steam from the sixth stage collection drain tank to the feedwater system, heater vents that discharge non-condensable gases to the moisture separators and the main condenser, and relief valves that discharge through a common header to atmosphere. During normal and abnormal operating conditions, due to its interfaces with the main condenser, the extraction steam system functions as part of the pressure boundary for main condenser vacuum. Main condenser vacuum boundary is required to mitigate the steam generator tube failure accident and the rod ejection accident.

LRA Table 2.3.4-4 identifies the components subject to an AMR for the Extraction Steam System by component type and intended function.

2.3.4.4.2 Staff Evaluation

The staff's review of LRA Section 2.3.4.4 and UFSAR Sections 10.3.3, 14.1.2.10, 14.2.2.2, and Table 10.4-1 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 RAI as discussed below.

In RAI 2.3.4.4-1, dated August 20, 2008, the staff noted that LRA Section 2.3.4.4 states that the extraction steam system meets the requirements of 10 CFR 54.4(a)(1), because it is a system that is relied upon to remain functional during and following DBEs. The staff could not identify the functions that support the 10 CFR 54.4(a)(1) designation provided by the extraction steam to verify the applicant did not omit any components from the scope of license renewal. The staff requested that the applicant provide additional information concerning the functions that support the 10 CFR 54.4(a)(1) designation provided by the extraction steam system and identify the components that perform these functions.

In its response to the RAI, dated September 16, 2008, the applicant stated that the extraction steam system performs no 10 CFR 54.4(a)(1) intended functions. The applicant stated that LRA Section 2.3.4.4, incorrectly states that the extraction steam system meets 10 CFR 54.4(a)(1) scoping criteria. The applicant stated that the extraction steam system is in scope for license renewal because it only meets 10 CFR 54.4(a)(2) criteria. In its response, the applicant amended the LRA by revising the first sentence in LRA Section 2.3.4.4 to explain why the system was not in scope under 10 CFR 54.4(a)(1) criteria.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-1 acceptable because the applicant clarified that the extraction steam system performs no 10 CFR 54.4(a)(1) intended function. The staff's concern described in RAI 2.3.4.4-1 is resolved.

2.3.4.4.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the extraction steam system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.5 Feedwater System

2.3.4.5.1 Summary of Technical Information in the Application

LRA Section 2.3.4.5 describes the feedwater system which is a normally operating system designed to maintain level in the OTSGs. The feedwater system is not required for safe plant shutdown or for maintaining the plant in the shutdown condition. The feedwater system consists of several plant systems including the main feedwater system, main feed pump turbines and auxiliaries system, and feedwater pump shaft seals & leakoff system.

The purpose of the feedwater system is to maintain level in the OTSGs throughout all modes of normal plant operation. The feedwater system accomplishes this by further heating deaerated, treated, and preheated condensate from the condensate system and delivering it to the OTSGs. The feedwater system delivers the water to the OTSGs to match the steam demand for the turbine load.

The feedwater system isolation and regulating valves automatically close to stop flow to the OTSGs on Hi-Hi OTSG level or indication of a feedwater or main steam system line break. Feedwater system isolation must be provided during an appendix R shutdown and is accomplished through the manual closure of the feedwater system isolation or regulating valves. The feedwater line to each OTSG is also provided with a check valve which serves as the reactor building isolation valve. The feedwater system pump turbine casing, pump recirculation line, and secondary side drains are necessary to establish the main condenser vacuum boundary, which is required to mitigate the steam generator tube failure accident and the rod ejection accident.

LRA Table 2.3.4-5 identifies the components subject to an AMR for the Feedwater System by component type and intended function.

2.3.4.5.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, UFSAR, and applicable boundary drawings, the staff concludes that the applicant has appropriately identified the feedwater system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an aging management review in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.6 Main Generator and Auxiliary Systems

2.3.4.6.1 Summary of Technical Information in the Application

LRA Section 2.3.4.6 describes the main generator and auxiliary systems whose intended function for license renewal is to maintain leakage boundary integrity to preclude system interactions. For this reason, the system's pressure retaining components located in proximity to other components performing safety-related functions have been included in the scope of license renewal.

The main generator and auxiliary systems is a normally operating system designed to convert the mechanical energy of the main turbine into electrical energy for distribution to the grid. The main generator and auxiliary system consists of several plant systems including the main generator, main generator excitation system, isolated phase bus duct cooling system, generator seal oil system, generator hydrogen cooling system, generator gas & vents system, and stator cooling system.

The purpose of the main generator and auxiliary system is to produce electricity. The system accomplishes this by converting mechanical energy provided by the main turbine into electrical energy. The electrical energy produced by the main generator is fed through an isolated phase bus to the main transformers for distribution to the grid. LRA Table 2.3.4-6 identifies the components subject to aging management review for the main generator and auxiliary systems by component type and intended function.

2.3.4.6.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA and UFSAR, the staff concludes there is reasonable assurance that the applicant has appropriately identified the main generator and auxiliary system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.7 Main Steam System

2.3.4.7.1 Summary of Technical Information in the Application

LRA Section 2.3.4.7 describes the main steam system which is a safety-related, normally operating system, designed to deliver energy in the form of steam, from the primary side of the plant to secondary side systems. The main steam system is capable of delivering steam to support normal plant operation up to 100% of design capacity and to support the plant cool-down during both normal operating conditions and design basis events.

The purpose of the main steam system is to provide steam to the appropriate secondary system components based on the plant conditions. It accomplishes this by directing steam to the turbine generator and main feedwater pump turbines during normal plant operation. Additionally, it provides gland seal steam and steam for relief valve support post heating. The main steam system includes moisture separators that remove moisture from steam exiting the high-pressure portion of the main turbine generator. In abnormal conditions, steam can be directed to the emergency feedwater pump turbine, the main condenser via the turbine bypass valves, or to the atmospheric dump valves as required to support safe shutdown of the plant.

During normal and abnormal operating conditions, due to its interfaces with the main condenser, the main steam system functions as part of the pressure boundary for main condenser vacuum. Main condenser vacuum boundary is required to mitigate the steam generator tube failure accident and the rod ejection accident. The functions of the main steam system are (1) main steam delivery, (2) relief valve support heating, (3) steam dump and turbine bypass, and (4) moisture separation.

LRA Table 2.3.4-7 identifies the components subject to an AMR for the Main Steam System by component type and intended function.

2.3.4.7.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, UFSAR, and applicable boundary drawings, the staff concludes that the applicant has appropriately identified the main steam system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an aging management review in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.8 Steam Turbine and Auxiliary Systems

2.3.4.8.1 Summary of Technical Information in the Application

LRA Section 2.3.4.8 describes the steam turbine and auxiliary system which is a normally operating system designed to convert the thermodynamic energy generated in the primary side of the plant into rotational mechanical energy to drive the main generator at the output of the plant.

The steam turbine and auxiliary system consists of the following plant systems: main turbine, electro-hydraulic control (EHC) system, turbine lift oil and lube oil system, turbine oil purification and transfer system, gland seal system, turbine drains, and main turbine exhaust hood spray. The purpose of the steam turbine and auxiliary system is to convert thermal energy into mechanical energy. The system accomplishes this by receiving thermal energy in the form of pressurized steam from the OTSGs, converting this thermal energy to mechanical energy through rotation of the turbine shaft. Exhaust steam is discharged into the main condenser, part of the condenser and air removal system. The main turbine system is directly connected to the main electric generator, part of the main generator and auxiliary system, which produces electrical energy for plant output. Turbine control is effected through the operation of the EHC system.

The turbine lift oil and lube oil system supplies oil to the main turbine thrust and journal bearings for heat removal and lubrication and maintains the quality of the oil.

The gland steam system provides low pressure steam for sealing main and feedwater pump turbine rotors and valve stems of the main turbine stop and control valves.

The turbine drain system provides moisture and water removal from steam lines to prevent water induction into the turbine.

The main turbine exhaust hood spray system provides cooling water to exhaust hood areas to prevent distortion of the turbine casings and support structures.

During normal and abnormal operating conditions, the steam turbine and auxiliary system functions as part of the pressure boundary for main condenser vacuum.

LRA Table 2.3.4-8 identifies the components subject to aging management review for the Steam Turbine and Auxiliary Systems by component type and intended function.

2.3.4.8.2 Staff Evaluation

The staff's review of LRA Section 2.3.4.8 and UFSAR Sections 7.1.2, 10.2.1, 10.2.2, 10.2.3, 14.1.2.9, 14.1.2.10, 14.2.2.2, and LRA Tables 10.2-1 and 10.2-2 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.4.8-1, dated August 20, 2008, the staff noted that on license renewal drawing LR-302-141, a turbine gland seal atmospheric drain tank is highlighted in red, indicating that it is within the scope of license renewal for 10 CFR 54.4(a)(2) criteria. Typically, this component type has a leakage boundary function. LRA Table 2.3.4-8 includes tanks as a component type and itemizes which tanks are included. However, the table does not include the turbine gland seal atmospheric drain tank as a component subject to an AMR. The staff requested that the applicant provide additional information to justify the exclusion of the turbine gland seal atmospheric drain tank from LRA Table 2.3.4-8.

In its response to the RAI, dated September 16, 2008, the applicant stated that the turbine gland seal atmospheric drain tank is a nonsafety-related tank within the scope of license renewal with a leakage boundary function and subject to aging management review; however, the tank is part of the condensate system and should have been included in LRA Tables 2.3.4-1 and 3.4.2-1. The applicant stated that boundary flags on license renewal drawings LR-302-141 and LR-302-172 incorrectly indicate the turbine gland seal atmospheric drain tank and associated piping as being part of the steam turbine and auxiliaries system. The applicant also stated that on license renewal drawing LR-302-141, one steam turbine and auxiliary's system flag should have been shown as a condensate system flag. The applicant amended the LRA by listing the turbine gland seal atmospheric drain tank with tanks of the same material, environment and aging effects under the component tanks with an intended function of leakage boundary in LRA Table 2.3.4-1. The applicant also amended the LRA by listing the turbine gland seal atmospheric drain tank under tanks with identical material, environment, and aging effects in LRA Table 3.4.2-1 with complete AMR results.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.8-1 acceptable because the applicant added the component "tanks" with an intended function of leakage boundary to the LRA Tables 2.3.4-1 and 3.4.2-1. The staff's concern described in RAI 2.3.4.8-1 is resolved.

In RAI 2.3.4.8-2, dated November 24, 2008, the staff noted that in LRA Section 2.3.4.2 the applicant stated that the condenser shell has the intended function of pressure boundary in accordance with 10 CFR 54.4(a)(2) for iodine partitioning. Typically on the turbine pedestal, there are drain lines originating in each of the wells where the turbine shaft penetrates the low pressure turbine housings for the purpose of draining condensate from excessive gland sealing steam. These drain lines penetrate the condenser housing where they originate and where they exit.

Neither LRA Section 2.3.4.2 nor Section 2.3.4.8 discuss this drain piping usually referred to as "slop drains." The failure of this piping is routinely reported in the industry and noted as a source of air inleakage to the condenser affecting vacuum. This drain piping would be a part of the pressure boundary for the condenser and included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) as a functional (a)(2) because its failure would affect the condenser shell's pressure boundary intended function. The staff requested that the applicant provide additional information to clarify whether the turbine pedestal "slop drains" lines are present and also justify their exclusion from the scope of license renewal under 10 CFR 54.4(a)(2).

In its response to the RAI, dated December 5, 2008, the applicant stated that the turbine pedestal "slop drains" are present and included in the scope of license renewal. The applicant stated that the drains perform a 10 CFR 54.4(a)(2) criteria intended function of functional support, because they form a portion of the pressure boundary for condenser shell vacuum, which is required for iodine partitioning and that the drains are shown on license renewal drawings LR-302-306 and LR-302-307 as 2-inch drain lines from the low-pressure turbine bearing drip pans to collection tanks LO-T-7A, LO-T-7B, and LO-T-7C. The applicant stated that this drain piping was incorrectly colored as red on the license renewal drawings and should have been colored green, representing a pressure boundary intended function.

Based on its review, the staff found the applicant's response to RAI 2.3.4.8-2 acceptable, because the applicant clarified the turbine pedestal "slop drains" are present, are in the scope of license renewal with a pressure boundary intended function, and should have been colored green. The staff's concern described in RAI 2.3.4.8-2 is resolved.

2.3.4.8.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the steam turbine and auxiliary system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures

This section documents the staff's review of the applicant's scoping and screening results for structures. Specifically, this section describes the following structures:

- Air intake structure
- Auxiliary building
- Circulating water pump house
- Control building
- Diesel generator building
- Dike/Flood control system
- Fuel handling building
- Intake screen and pump house
- Intermediate building
- Mechanical draft cooling tower structures
- Miscellaneous yard structures
- Natural draft cooling tower

- Structural commodities
- Reactor building
- SBO diesel generator building
- Service building
- Component supports commodity group
- Substation structures
- Turbine building
- UPS diesel building

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

The staff's evaluation of the information provided in the LRA was performed in the same manner for all structures. The objective of the review was to determine if the structural components that appeared to meet the scoping criteria specified in the Rule, were identified by the applicant as within the scope of license renewal, in accordance with 10 CFR 54.4. Similarly, the staff evaluated the applicant's screening results to verify that all long-lived, passive SCs were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

To perform its evaluation, the staff reviewed the applicable LRA sections, focusing its review on components that had not been identified as within the scope of license renewal. The staff reviewed the UFSAR for each structure to determine if the applicant had omitted components with intended functions delineated under 10 CFR 54.4(a) from the scope of license renewal. The staff also reviewed the UFSAR to determine if all intended functions delineated under 10 CFR 54.4(a) were specified in the LRA. If omissions were identified, the staff requested additional information to resolve the discrepancies.

Once the staff completed its review of the scoping results, the staff evaluated the applicant's screening results. For those components with intended functions, the staff sought to determine: (1) if the functions are performed with moving parts or a change in configuration or properties, or (2) if they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those that did not meet either of these criteria, the staff sought to confirm that these structural components were subject to an AMR as required by 10 CFR 54.21(a)(1). If discrepancies were identified, the staff requested additional information to resolve them.

2.4.1 Air Intake Structure

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 describes the air intake structure which is a seismic class I reinforced concrete structure located approximately 300 feet southwest of the reactor building. The air intake structure includes an above grade reinforced concrete box like structure and a below grade tunnel that provides a pathway for outside air from the air intake to the auxiliary building, control building and fuel handling building.

The purpose of the air intake structure is to provide a source of makeup air or outside air to the ventilation systems of the auxiliary, control, and fuel handling buildings and to provide structural support, shelter and protection for the components housed within.

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

2.4.1.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the Air Intake Structure SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2 Auxiliary Building

2.4.2.1 Summary of Technical Information in the Application

LRA Section 2.4.2 describes the auxiliary building, which includes the auxiliary building, heat exchanger vault, access tunnel vault, exhaust air tunnel, chem storage room, and ESF ventilation room. The auxiliary building is a seismic class I structure located south west of the reactor building and west of the fuel handling building, and is a reinforced concrete structure with one story above grade.

The heat exchanger vault is a seismic class I reinforced concrete structure attached to the west wall of the auxiliary building. The access tunnel vault is a seismic class I reinforced concrete structure attached to the north wall of the auxiliary building. The exhaust air tunnel is a seismic class I reinforced concrete structure attached to the north wall of the auxiliary building. The chem storage and ESF ventilation rooms are separate, nonsafety-related, steel-framed structures, with metal siding and metal roofing protected with roofing materials, located on the auxiliary building reinforced concrete roof slab.

The auxiliary building, heat exchanger vault, access tunnel vault, and exhaust air tunnel are designed for normal operating loads and to withstand the effects of design basis accident loads as applicable. The chem storage room and ESF ventilation room are designed for normal operating loads only.

The purpose of the auxiliary building, access tunnel vault, and heat exchanger vault is to provide structural support, shelter, and protection for vital mechanical and electrical equipment required for safe operation of the plant, including safe shutdown of the reactor. The purpose of the exhaust air tunnel portion of the auxiliary building is to allow exhaust air from the auxiliary building, reactor building, fuel handling building, and control building ventilation systems to be directed to the exhaust vent stack located on the west side of the reactor building. The purpose of the chem storage and ESF ventilation rooms is to provide structural support, shelter, and protection for nonsafety-related equipment housed within, and to maintain their structural integrity to ensure that they will not adversely affect the components housed within, or the auxiliary building, from performing their intended functions.

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

2.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.2, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the auxiliary building.

In RAI 2.4.2-1, dated August 22, 2008, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of a UFSAR-referenced flood gate separating the auxiliary building from the turbine building with respect to the scope of license renewal.

In its response to the RAI, dated September 19, 2008, the applicant stated that the flood gate was in scope for license renewal and subject to an AMR. The response stated that the flood gate was classified under the title "bulkhead" in Table 2.4-2 and that the intended function for the bulkhead entry in Table 2.4-2 is listed as "flood barrier."

Based on its review, the staff finds the response to RAI 2.4.2-1 acceptable because the bulkhead component that bears the intended function of flood barrier includes the UFSAR-referenced flood gate; it has been designated as in scope for license renewal, and it is subject to an AMR. The staff's concern described in RAI 2.4.2-1 is resolved.

In RAI 2.4.0-1, dated August 22, 2008, the staff requested that the applicant provide additional information, to confirm the component identified as "steel components: all structural steel" in various tables in LRA Section 2.4 includes the connection components (gusset plates, welds, bolts, etc.).

In its response to the RAI, dated September 19, 2008, the applicant stated that the connection components (e.g., gusset plates, welds, etc.) for in-scope license renewal SSCs are in scope and subject to an AMR.

Based on its review, the staff finds the response to RAI 2.4.0-1 acceptable because the applicant confirmed that all connection components are in scope and subject to an AMR. The staff's concern described in RAI 2.4.0-1 is resolved.

In RAI 2.2-1, dated August 22, 2008, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the class I chemical cleaning building basin with respect to the scope of license renewal.

In its response to the RAI, dated September 19, 2008, the applicant stated that the chemical cleaning building basin had been designed according to class I criteria, but it did not meet any of the scoping criteria of 10 CFR 54.4(a). The applicant stated that the class I criteria was selected due to the chemical cleaning building basin's function to support the processing of low-level, liquid radioactive waste. For this reason, the applicant found the chemical cleaning building basin to be excluded from the scope of license renewal.

Based on its review, the staff finds the response to RAI 2.2-1 acceptable because the CLB of the applicant does not define the chemical cleaning building basin as a safety-related component per 10 CFR 54.4(a)(1), nor would its failure prevent the fulfillment of a safety-related SSC per 10 CFR 54.4(a)(2), nor is it relied upon to fulfill a regulatory function in accordance with 10 CFR 54.4(a)(3). The staff's concern described in RAI 2.2-1 is resolved.

2.4.2.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs in scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the auxiliary building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.3 Circulating Water Pump House

2.4.3.1 Summary of Technical Information in the Application

LRA Section 2.4.3 describes the circulating water pump house which includes the circulating water pump house, the circulating water flume canal and intake tunnel. The circulating water pump house is a class III structure located west of and between the Unit 1 cooling towers approximately 700 feet northeast of the Unit 1 reactor building.

The circulating water pump house consists of a below grade reinforced portion and an above grade steel superstructure enclosed with insulated aluminum siding. The building contains six circulating water pumps arranged so that three pumps discharge through each of the two 102-inch diameter pipes.

The circulating water flume canal and tunnel are reinforced concrete structures that are used to convey water from the cooling tower basins to the Circulating Water Pump House.

The purpose of the circulating water pump house is to provide structural support, and shelter and protection for the circulating water pumps which are required to provide the necessary cooling water to the turbine condenser to maintain condenser vacuum. Condenser vacuum is credited for the steam generator tube failure accident and the rod ejection accident as described in Chapter 14 of the UFSAR. Additionally, the diesel driven circulating water flume fire pump required for 10 CFR 50.48 is located within the circulating water pump house and draws suction from the circulating water flume canal. The pump house provides structural support, and shelter and protection for this diesel fire pump. LRA Table 2.4-3 identifies the components subject to aging management review for the circulating water pump house by component type and intended function.

2.4.3.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the circulating water pump house SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.4 Control Building

2.4.4.1 Summary of Technical Information in the Application

LRA Section 2.4.4 describes the control building which is a seismic class I multi-story reinforced concrete structure located southeast of the reactor building, east of the fuel handling building, and west of the turbine building.

The building is designed to withstand the effects of normal operating loads and design basis accident loads, which include the effects of tornado loads, including tornado missiles, flooding, earthquakes, aircraft impact, and equipment-generated missiles.

The purpose of the building is to provide structural support, shelter, and protection for vital mechanical and electrical equipment required for safe operation of the plant, including safe shutdown of the reactor. The building provides structural support and shelter and protection for the control room, which is the main operation center for the plant. The building houses safety-related electrical and mechanical equipment and components, such as the cable spreading room, essential DC batteries, electrical inverters, electrical switchgear, miscellaneous electrical equipment, components and their enclosures, instrumentation and their enclosures as applicable, and control room and control building HVAC. The control building also provides shielding from post-accident radiation exposure to allow personnel access for operating and maintaining equipment.

LRA Table 2.4-4 identifies the components subject to an AMR for the control building by component type and intended function.

2.4.4.2 Staff Evaluation

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

During its review of the LRA Section 2.4.4, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant’s scoping and screening results for the control building.

In RAI 2.4.4-1, dated August 22, 2008, the staff requested that the applicant provide additional information to confirm the inclusion, or justify the exclusion, of a UFSAR-referenced flood gate separating the control building from the turbine building with respect to the scope of license renewal.

In its response to the RAI, dated September 19, 2008, the applicant stated that the flood gate was in scope for license renewal and subject to an AMR. The response stated the flood gate was classified under the title “Metal Components: All Structural Members” in Table 2.4-4. The intended function for this component entry in Table 2.4.4 is listed as flood barrier.

Based on its review, the staff finds the response to RAI 2.4.4-1 acceptable because the “metal components” entry, which bears the intended function of flood barrier, includes the

UFSAR-referenced flood gate; it has been designated as in scope for license renewal, and it is subject to an AMR. The staff's concern described in RAI 2.4.4-1 is resolved.

2.4.4.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the control building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.5 Diesel Generator Building

2.4.5.1 Summary of Technical Information in the Application

LRA Section 2.4.5 describes the diesel generator building which is a single-story, above-grade, reinforced concrete structure, located adjacent to the north wall of the intermediate building and west of the service building.

The building is a seismic class I structure designed to withstand the effects of normal operating loads and design basis accident loads which include tornado loads, tornado missiles, flooding, earthquakes, and equipment-generated missiles.

The building houses the safety-related emergency diesel generators, the diesel fuel oil day tanks, electrical and mechanical equipment associated with operation of the diesel generators, and other safety-related and nonsafety-related components. The building is divided into two equal rooms for each diesel generator by an east-west wall. Openings in the roof allow exhaust air to exit the building. The exhaust mufflers for each of the diesel generators are enclosed on the roof of the building within a structural steel frame on a thickened portion of the reinforced concrete roof slab.

The purpose of the building is to provide structural support, shelter, and protection for vital mechanical and electrical equipment required for safe operation of the plant, including safe shutdown of the reactor. The building also provides shielding from post-accident radiation exposure to allow personnel access for operating and maintaining the diesel generators.

LRA Table 2.4-5 identifies the components subject to an AMR for the diesel generator building by component type and intended function.

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.5 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.5, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the diesel generator building.

In RAI 2.4.5-1, dated August 22, 2008, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the UFSAR-referenced flood gates at elevation 305' with respect to the scope of license renewal.

In its response to the RAI, dated September 19, 2008, the applicant stated that the flood gates were in scope for license renewal and subject to an AMR. The response stated that the flood gate was classified under the title “Metal Components: All Structural Members” in Table 2.4-5. The intended function for this component entry in Table 2.4-5 is listed as “flood barrier.” The staff finds the response to RAI 2.4.5-1 acceptable because the “metal components” entry, which bears the intended function of flood barrier, includes the UFSAR-referenced flood gates; it has been designated as in scope for license renewal, and it is subject to an AMR. The staff’s concern described in RAI 2.4.5-1 is resolved.

During its review of Section 2.4-5 of the LRA, the staff noted that steel panels were installed on the diesel generator building to protect the equipment from potential tornado missiles. However, Table 2.4-5 did not include “missile barrier” as an intended function of the building’s structural steel. In RAI 2.4.5-2, dated August 22, 2008, the staff requested that the applicant provide additional information to address the absence of the intended function “missile protection” from Table 2.4-5.

In its response to the RAI, dated September 19, 2008, the applicant stated that the intended function of missile barrier should have been included in Tables 2.4-5 and 3.5.2-5. The intended function was added and the AMR information was updated.

Based on its review, the staff finds the response to RAI 2.4.5-2 acceptable because the intended function of missile barrier has been added to the appropriate LRA tables. The staff’s concern described in RAI 2.4.5-2 is resolved.

2.4.5.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the diesel generator building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.6 Dike/Flood Control System

2.4.6.1 Summary of Technical Information in the Application

LRA Section 2.4.6 describes the dike/flood control system which consists of protective dikes and a storm drainage and flood control structure that protects the site from floods from the river.

The dikes are nonsafety-related earth embankments, constructed of clay and silt and are protected by rip-rap and sand and gravel embedment material to withstand wave action and a velocity in excess of 12.0 ft/sec, on a 2-on-1 slope.

Included within the east side dike is the nonsafety-related reinforced concrete storm drainage and flood control structure that penetrates the dike. Storm water collects in the earthen basin for this structure on the inboard side of the dike. Influent and effluent reinforced concrete headwalls on the inboard and outboard sides of the dike are connected with a below grade corrugated metal pipe (CMP). Water collected in the earthen basin is drained to the river after sampling during normal river flows. This structure also contains a sluice gate and associated operator supported by a structural steel platform on the inboard side of the dike. The sluice gate allows storm water collected in the earthen basin to be sampled prior to discharge to the river.

The purpose of the dike/flood control system is to provide protection for the site structures and equipment for a design flood of 304'-0".

LRA Table 2.4-6 identifies the components subject to an AMR for the dike/flood control system by component type and intended function.

2.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.4.6 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.6, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the dike/flood control system.

In RAI 2.4.6-1, dated August 22, 2008, the staff requested that the applicant provide additional information and confirm the inclusion or justify the exclusion of a structural steel platform associated with the support of the in-scope sluice gate and operator of the dike/flood control system.

In its response to the RAI, dated September 19, 2008, the applicant stated the structural steel platform was in-scope for license renewal and subject to an AMR. The applicant further stated that Section 2.4.6 of the LRA was modified to explicitly specify the inclusion of the platform. Tables 2.4-6 and 3.5.2-6 were both revised to address the steel platform.

Based on its review, the staff finds the response to RAI 2.4.6-1 acceptable because the structural steel platform has been included in the scope of license renewal, and the appropriate LRA tables have been revised accordingly. The staff's concern described in RAI 2.4.6-1 is considered resolved.

In RAI 2.4.6-2, dated November 24, 2008, the staff noted that on license renewal drawing LR-1E-120-01-001, the storm drainage and flood control structure is shown outlined in black, indicating that the structure is not within the scope of license renewal. In LRA Section 2.4.6, "dike/flood control system," the applicant stated that the dike/flood control system is in scope under 10 CFR 54.4(a)(2) and, since it was identified as being in scope of license renewal, it should be highlighted as such on the license renewal drawing. The staff requested that the applicant provide additional information to justify the exclusion of the storm drainage and flood control structure from the scope of license renewal on the license renewal drawing.

In its response to the RAI, dated December 5, 2008, the applicant stated that the storm drainage and flood control structure is in scope for license renewal under 10 CFR 54.4(a)(2) as indicated in LRA Section 2.4.6, "dike/flood control system," and that license renewal drawing LR-1E-120-01-001 at location G-4 should have shown the storm drainage and flood control structure outlined in green, indicating that the structure is in scope for license renewal.

Based on its review, the staff finds the response to RAI 2.4.6-2 acceptable because the applicant indicated that the Storm Drainage and Flood Control Structure is in scope for license renewal and the storm drainage and flood control structure on the drawing should have been outlined in green indicating that the structure is in scope for license renewal. The staff's concern described in RAI 2.4.6-2 is considered resolved.

2.4.6.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the Dike/Flood Control System SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.7 Fuel Handling Building

2.4.7.1 Summary of Technical Information in the Application

LRA Section 2.4.7 describes the fuel handling buildings which are multi story reinforced concrete structures with three stories above grade and with below grade basements. The Unit 1 fuel handling building is located south of and adjacent to the reactor building.

The fuel handling building contains the spent fuel pools, spent fuel cooling pumps and coolers, and new fuel storage vault. Two fuel transfer tubes in the reactor building penetrate the north fuel handling building wall that allow for fuel movement between the fuel transfer canal in the reactor building and the spent fuel storage pool in the fuel handling building. The tubes contain tracks for the fuel transfer carriages, gate valves on the fuel handling building side, and a flanged closure on the reactor building side.

The Unit 2 fuel handling building is located south of and adjacent to the Unit 1 fuel handling building. Both buildings share a common area above elevation 348'-0" and the fuel handling building truck bay. The buildings are maintained at a negative pressure with respect to the outside environment by the fuel handling building normal ventilation system (FHBNVS) during normal operations and by the fuel handling building engineered safety feature ventilation system (FHBESFVS) during movement of irradiated fuel.

The Unit 1 Fuel Handling Building is a seismic class I structure and is designed for normal operating loads and also to withstand the effects of design basis accident loads as applicable, which include the effects of tornado loads including tornado missiles, flooding, earthquake, aircraft impact and equipment generated missiles. The Unit 2 fuel handling building is required to withstand the effects of tornado loads including tornado missiles and aircraft impact to protect the south end of the Unit 1 fuel handling building.

The purpose of the fuel handling buildings is to provide structural support, shelter and protection for the spent fuel cooling pumps, new and spent fuel storage racks, spent fuel pools and electrical and mechanical equipment required for safe operation of the plant, including safe shutdown of the reactor. The Unit 1 fuel handling building also provides shielding from post accident radiation exposure to allow personnel access for operating and maintaining equipment.

LRA Table 2.4-7 identifies the components subject to an AMR for the Fuel Handling Buildings by component type and intended function.

2.4.7.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the fuel handling building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.8 Intake Screen and Pump House

2.4.8.1 Summary of Technical Information in the Application

LRA Section 2.4.8 describes the intake screen and pump house which includes the intake screen and pump house (ISPH), the intake canal located in the Susquehanna River and the nonsafety-related diesel fire pump house, which is located on the north side of the ISPH.

The intake screen and pump house is a seismic class I reinforced concrete structure located west south west of the reactor building, along the western shoreline. The design of the structure ensures that the pumps remain operable if the site is subject to the maximum flood level. The building is designed to withstand the effects of normal operating loads and design basis accident loads, which include the effects of tornado loads including tornado missiles, flooding, ice jams, earthquake, aircraft impact and equipment generated missiles.

The intake canal has been constructed in the Susquehanna River bed's channel to the east of the intake screen and pump house to assure that there is a source of cooling water for the safe operation and shutdown of the plant.

The diesel fire pump house is also a reinforced concrete structure attached to the north wall of the ISPH. The building is designed to withstand the effects of normal operating loads.

LRA Table 2.4-8 identifies the components subject to aging management review for the Intake Screen and Pump House by component type and intended function.

2.4.8.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the intake screen and pump house SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.9 Intermediate Building

2.4.9.1 Summary of Technical Information in the Application

LRA Section 2.4.9 describes the intermediate building which includes the seismic class I portion of the building and the class III or nonsafety-related portion of the building.

The seismic class I portion of the building is a reinforced concrete multi-story structure above grade with a portion of the structure approximately 10 feet below grade and is located north of and adjacent to the reactor building. The nonsafety-related portion of the building is a multi-story above grade steel framed structure and is located east of and adjacent to the reactor building and west of the heater bay portion of the turbine building.

The seismic class I portion of the building contains the class I main steam piping, pumps and turbines and electrical and mechanical equipment and emergency feedwater piping required for safe operation of the plant, including safe shutdown of the reactor. The nonsafety-related portion of the building contains main steam and class 1 emergency feedwater system piping required for safe operation of the plant, including safe shutdown of the reactor and 480V load centers and switchgear.

The seismic class I portion of the building is designed to withstand the effects of normal operating and design basis accident loads which include the effects of tornado loads including tornado missiles, flooding, earthquake and main steam turbine missiles.

LRA Table 2.4-9 identifies the components subject to an AMR for the Intermediate Building by component type and intended function.

2.4.9.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the intermediate building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.10 Mechanical Draft Cooling Tower Structures

2.4.10.1 Summary of Technical Information in the Application

LRA Section 2.4.10 describes the MDCT structures which include the MDCT basin, the intake water shut-off chamber, a building at the south end of the MDCT basin, the foundation and dike for the sodium bisulfate tank, and the discharge structure—bldg. 332. All these structures are Class III and located southwest of the reactor building.

The MDCT basin consists of a multi-cell, reinforced concrete box, partly underground and partly above ground. The basin has an adjoining Unit 2 structure on the south end, which does not contain any equipment associated with the operation of Unit 1.

The intake water shut-off chamber is a reinforced concrete box, also partly above ground and partly underground, with steel grating covering the open top.

The building at the south end of the MDCT basin consists of reinforced masonry block and concrete walls and a reinforced concrete roof slab. The building currently houses obsolete equipment associated with operation of the MDCT prior to removal of the mechanical draft cooling tower fill.

The discharge structure is a reinforced concrete box partly underground and partly above ground.

The purpose of the MDCT basin, the intake water shut-off chamber, and the discharge structure is to provide support for the inlet and outlet river discharge piping associated with the safety-related nuclear services and decay heat river water systems. The MDCT basin, including the internal walls, the intake water shut-off chamber, and the discharge structure are also required to maintain their structural integrity to provide a flow path for the inlet and outlet river discharge piping.

LRA Table 2.4-10 identifies the components subject to an AMR for the MDCT structures by component type and intended function.

2.4.10.2 Staff Evaluation

The staff reviewed LRA Section 2.4.10 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.10, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the MDCT structures .

In RAI 2.4.10-1, dated August 22, 2008, the staff requested that the applicant provide additional information to justify the LRA statement that failure of the out-of-scope MDCT building, adjoining Unit 2 structure, and sodium bisulfate tank foundation and dike would not affect the intended function of the in-scope MDCT basin.

In its response to the RAI, dated September 19, 2008, and its supplemental response to the RAI, dated November 3, 2008, the applicant stated that hypothetical failure of the out-of-scope MDCT building, adjoining Unit 2 structure, and sodium bisulfate tank foundation and dike was not part of the CLB.

Based on its review, the staff finds the response to RAI 2.4.10-1 acceptable because Section 2.1.3.1.2 of the SRP-LR states that the applicant is required to identify and evaluate only those nonsafety-related SSCs whose failures are considered in the CLB and could prevent the fulfillment of a 10 CFR 54.4(a)(1) safety function. The MDCTs, adjoining Unit 2 structure, and sodium bisulfate tank foundation and dike do not meet these criteria. The staff's concern described in RAI 2.4.10-1 is resolved.

2.4.10.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the mechanical draft cooling structures SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.11 Miscellaneous Yard Structures

2.4.11.1 Summary of Technical Information in the Application

LRA Section 2.4.11 describes the miscellaneous yard structures which includes the following:

(a) condensate storage tank foundation
(b) borated water storage tank foundation
(c) diesel fuel storage tank foundation
(d) altitude tank foundation
(e) duct banks and manholes

There are two condensate storage tanks and each tank has a 265,000 gallon capacity. One tank is located east of the service building and the other tank is located west of the outage equipment storage building. These tanks provide a source of water for the main and emergency feedwater system and for systems credited for fire protection and SBO.

The borated water storage tank provides a source of borated water for the ECCS and the reactor building spray system.

The diesel fuel storage tank is a 30,000 gallon capacity tank that provides a source of fuel oil for the EDGs.

The altitude tank provides an alternate source of water for the fire suppression system. The tank has a 100,000 gallon capacity and is located approximately 400 feet north of the reactor building.

Duct banks are multiple raceways that are encased in reinforced concrete and buried within the soil or compacted backfill. The duct banks' intended functions are to provide structural support and shelter and protection for raceways.

Manholes serve as intermediate connection point(s) of duct banks that contain safety-related raceways or support a 10 CFR 54.4 a(2) function for 10 CFR 54.4 a(1) components or contain raceways required for Fire Protection or Station Blackout. Manholes are reinforced concrete boxes (cast in-place or precast) that are buried within the soil or compacted backfill. The manholes provide structural support and shelter and protection for electrical cable or raceway that are used to route the electrical cable.

LRA Table 2.4-11 identifies the components subject to an AMR for the miscellaneous yard structures by component type and intended function.

2.4.11.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the miscellaneous yard structures SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.12 Natural Draft Cooling Towers

2.4.12.1 Summary of Technical Information in the Application

LRA Section 2.4.12 describes the natural draft cooling towers, which are classified as Class III structures and include the reinforced concrete hyperbolic towers, the wooden fill structure, the canopy at the base of the towers, and the reinforced concrete basin. The natural draft cooling towers are located approximately 600 feet northeast of the reactor building.

The purpose of the reinforced concrete basin of the natural draft cooling towers is to provide a source of water for the circulating water pump house. The diesel fire pump required for 10 CFR 50.48 is located within the circulating water pump house. The diesel fire pump draws suction from the circulating water flume canal and tunnel. Additionally, the circulating water pumps located within the circulating water pump house are required to provide the necessary cooling water to the turbine condenser to maintain condenser vacuum.

LRA Table 2.4-12 identifies the components subject to an AMR for the natural draft cooling towers by component type and intended function.

2.4.12.2 Staff Evaluation

The staff reviewed LRA Section 2.4.12 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.12, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the natural draft cooling towers.

In RAI 2.4.12-1, dated August 22, 2008, the staff requested that the applicant provide additional information to justify the LRA statement that failure of the out-of-scope reinforced concrete hyperbolic towers, the wooden fill structure, and the canopy would not affect the intended function of the in-scope reinforced concrete basins.

In its response to the RAI, dated September 19, 2008, and its supplemental response to the RAI, dated November 3, 2008, the applicant stated that hypothetical failure of the out-of-scope reinforced concrete hyperbolic towers, the wooden fill structure, and the canopy were not part of the CLB.

Based on its review, the staff finds the response to RAI 2.4.12-1 acceptable because Section 2.1.3.1.2 of the SRP-LR states that the applicant is required to identify and evaluate only those nonsafety-related SSCs whose failures are considered in the CLB and could prevent the fulfillment of a 10 CFR 54.4(a)(1) safety function. The hyperbolic cooling towers, the wooden fill structures, and the canopy do not meet these criteria. The staff's concern in RAI 2.4.12-1 is resolved.

2.4.12.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the natural draft cooling tower SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.13 Structural Commodities

2.4.13.1 Summary of Technical Information in the Application

LRA Section 2.4.13 describes the structural commodities which are component groups that share material and environment properties allowing a common program to manage their aging effects. Structural commodities include structural bolting, concrete anchors and embedments, conduit, cable trays, tube track, cabinets, enclosures, racks, frames and panels for electrical equipment and instrumentation, penetration sleeves including end caps, penetration seals, bus ducts, and piping and component insulation.

Structural bolting includes bolting which provides structural support for connections associated with structural steel assemblies which are in scope for license renewal.

Concrete anchors and embedments (i.e., embedded plates) include expansion and grouted anchor bolts and embedments (including studs) that perform an intended function for structural support for various structural, mechanical and electrical system components and commodities that are in scope for license renewal.

Conduit, cable trays, tube track, cabinets, enclosures, racks, frames and panels for electrical equipment and instrumentation in scope for license renewal include those items that provide structural support or shelter and protection for various mechanical and electrical system components and commodities that are in scope for license renewal.

Penetration sleeves including end caps and penetration seals in scope for license renewal include those items that perform various license renewal intended functions for shelter and protection, flood barrier, pressure boundary, radiation shielding and HELB shielding for structures that are in scope for license renewal.

Bus ducts and associated rain covers in the scope for license renewal include those items that perform a license renewal intended function for shelter and protection for metal enclosed buses that are in scope for license renewal.

Piping and component insulation includes the insulation and associated metal jacketing for all piping and components. Piping insulation and component insulation is comprised of prefabricated blankets, modules, or panels engineered as integrated assemblies to fit the surface to be insulated and to fit easily against the piping and components. Metallic insulation consists of stainless steel mirror insulation. Nonmetallic insulation consists of asbestos and light density, semi-rigid fibrous glass (pad) insulation, quilted between two layers of glass scrim and encapsulated in a fiberglass cloth, jackets forming a composite blanket; premolded fiberglass modules and panels encased in fiberglass cloth jackets or calcium silicate. Anti-sweat or freeze protection insulation consists of closed cell, foamed plastic type, cellular glass or fiberglass (inside containment) and fiberglass or mineral wool (outside containment). Metal protective jackets are made from rolled aluminum or stainless steel.

The purpose of insulation is to improve thermal efficiency, minimize heat loads on the HVAC systems, provide for personnel protection, or prevent freezing of heat traced piping and sweating of cold piping and components. The insulation jacketing shelters and protects the associated insulation. Insulation is also used to protect penetration concrete in close proximity to hot piping to maintain concrete temperatures within allowable limits.

LRA Table 2.4-13 identifies the components subject to an AMR for the Structural Commodities by component type and intended function.

2.4.13.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the structural commodities SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.14 Reactor Building

2.4.14.1 Summary of Technical Information in the Application

LRA Section 2.4.14 describes the reactor building which is a post-tensioned reinforced concrete structure with a cylindrical wall, a flat foundation mat, and a shallow dome roof that is designed to withstand the effects of design basis accident loads as applicable, which include the effects of tornado wind, missiles, flooding, earthquakes, LOCA, aircraft impact, and equipment generated missiles.

The reactor building contains the fuel transfer canal, which is a reinforced concrete structure lined with a stainless steel plate above the reactor vessel, and filled with borated water for refueling. The south (deep) portion of the fuel transfer canal is normally used for the storage of the reactor vessel internals and plenum assembly.

Two fuel transfer tubes in the fuel transfer canal penetrate the south wall of the reactor building and the north wall of the fuel handling building, which allows for fuel movement between the fuel transfer canal and the spent fuel storage pool.

The reactor building interior structure consists of the basement floor, intermediate floor, operating floor, reactor cavity, two steam generator compartments, refueling transfer canal, equipment supports, piping supports and pipe-whipping restraints, removable CRDM missile shield, and incore instrumentation trench.

In addition, the reactor building includes the following exterior structural features:

- annular reinforced concrete tendon access gallery

- exterior reinforced concrete retaining wall and associated roof
- ventilation exhaust stack

LRA Table 2.4-14 identifies the components subject to an AMR for the reactor building by component type and intended function.

2.4.14.2 Staff Evaluation

The staff reviewed LRA Section 2.4.14 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.14, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the reactor building.

In RAI 2.4.14-1, dated August 22, 2008, the staff requested that the applicant provide additional information and confirm that the inaccessible floor liner plate, including the leak chase system and the concrete fill slab above this liner, are included in the components listed in Table 2.4-14.

In its response to the RAI, dated September 19, 2008, the applicant stated that the inaccessible floor liner plate is within the scope of license renewal and subject to an AMR and that it has been included in LRA Table 2.4-14 under the component type "steel elements: liner, liner anchors, and integral attachments." The applicant further stated that the concrete fill slab was also within the scope of license renewal and subject to an AMR and was included under the component type "concrete: interior" in LRA Table 2.4-14. The response further stated that the "leak chase system" referred to by the staff is referred to as test channels by the applicant's UFSAR and that the test channels do not perform collection or monitoring functions associated with leakage. The applicant further stated that the test channels were not within the scope of license renewal because they do not perform a 10 CFR 54.4(a) intended function for license renewal. The applicant did state, however, that the fillet welds which attach the test channels to the containment liner are considered integral attachments and included within the scope of license renewal and subject to an AMR under the component type "steel element: liner, liner anchors, and integral attachment."

Based on its review, the staff finds the response to RAI 2.4.14-1 acceptable because the test channels, as described by the applicant, do not perform a 10 CFR 54.4(a) intended function for license renewal. Additionally, the fillet weld which forms the containment boundary has been included within the scope of license renewal and is subject to an AMR. The staff's concern described in RAI 2.4.14-1 is resolved.

2.4.14.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the reactor building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.15 SBO Diesel Generator Building

2.4.15.1 Summary of Technical Information in the Application

LRA Section 2.4.15 describes the SBO diesel generator building which is a single story reinforced concrete structure located adjacent to the west wall of the Unit 2 fuel handling building.

The building contains the SBO diesel generator and associated electrical and mechanical equipment rooms, the abandoned Unit 2 “B” diesel generator, and the fuel oil storage tank rooms.

The purpose of the building is to provide structural support, shelter and protection for the nonsafety-related SBO diesel generator, the SBO diesel oil storage tank, electrical and mechanical components associated with operation of the SBO diesel generator and other nonsafety-related components.

LRA Table 2.4-15 identifies the components subject to an AMR for the SBO diesel generator building by component type and intended function.

2.4.15.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the SBO diesel generator building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.16 Service Building

2.4.16.1 Summary of Technical Information in the Application

LRA Section 2.4.16 describes the service building, which includes the service building and machine shop, which are class III structures and are designed to withstand the effects of normal operating loads. The service building and machine shop are adjacent to each other and are located northeast of the reactor building and north of the turbine building.

The service building is a single-story, above-grade, steel-framed structure. The machine shop is a two-story, above-grade, steel-framed structure. The purpose of the service building is to provide structural support, shelter, and protection for safety-related mechanical components required for safe operation of the plant, including safe shutdown of the reactor. The machine shop also provides structural support, shelter, and protection for components required for fire protection.

LRA Table 2.4-16 identifies the components subject to an AMR for the service building by component type and intended function.

2.4.16.2 Staff Evaluation

The staff reviewed LRA Section 2.4.16 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of LRA Section 2.4.16, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the service building.

In RAI 2.4.16-1, dated August 22, 2008, the staff requested that the applicant provide additional information to clarify two seemingly contradictory statements from the LRA and the UFSAR regarding the service building. The staff noted that the LRA stated that the service building provided support and shelter to "…safety-related mechanical components required for safe operation of the plant, including safe shutdown of the reactor." The staff also noted that Section 5.1.1.3 of the UFSAR lists the service building as a class III structure. By definition noted in the UFSAR, class III SSCs are not related to reactor operation.

In its response to the RAI, dated September 19, 2008, the applicant stated that the service building is a class III structure which houses safety-related equipment. By the standard of 10 CFR 54.4(a)(2), the service building is within the scope of license renewal. Furthermore, the need for clarification of the contradictory statements was entered into the Unit 1 corrective action program.

Based on its review, the staff finds the response to RAI 2.4.16-1 acceptable because the service building was determined to be within the scope of license renewal as required by 10 CFR 54.4(a)(2). Furthermore, the applicant entered the contradictory statements into its corrective action program for resolution. The staff's concern described in RAI 2.4.16-1 is resolved.

In RAI 2.4.16-2, dated August 22, 2008, the staff requested that the applicant provide additional information to confirm that the reinforced concrete circulating water pipe tunnel which provides support for the service building is in the scope of license renewal.

In its response to the RAI, dated September 19, 2008, the applicant stated that the pipe tunnel itself was included in Section 2.3.3.3, circulating water system, of the LRA. Specifically, the tunnel was stated to be encompassed in Table 2.3.3-3 under the component type "piping and fittings." The response did indicate, however, that the intended function of "structural support," as inquired by the staff, had been unintentionally omitted from the table. As a result, several sections of the LRA required revision to include this intended function.

Based on its review, the staff finds the response to RAI 2.4.16-2 acceptable because the reinforced concrete circulating water pipe tunnel has been included in the scope of license renewal, and the appropriate sections of the LRA have been properly updated to reflect the intended function of "structural support." The staff's concern described in RAI 2.4.16-2 is resolved.

2.4.16.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the service building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.17 Component Supports Commodity Group

2.4.17.1 Summary of Technical Information in the Application

LRA Section 2.4.17 describes the component supports commodity group which consists of structural elements and specialty components designed to transfer the load applied from a SSC to the building structural element or directly to the building foundation. The commodity group is comprised of the following supports:

- supports for ASME class 1, 2 and 3 piping and components
- constant and variable load spring hangers, guides and stops
- anchorage of racks, panels, cabinets, and enclosures for electrical equipment and instrumentation
- supports for cable trays, conduit, HVAC ducts, instrument tubing, non-ASME piping and components
- supports for emergency diesel generator and HVAC system components
- supports for platforms, pipe whip restraints, jet impingement shields and masonry walls

The purpose of a support is to transfer gravity, thermal, seismic, and other lateral loads imposed on or by a SSC to the supporting building structural element or foundation.

The component support commodity group includes supports for mechanical, electrical and instrumentation systems, components and structures, and supports for SSCs, which are required to restrain or prevent physical interaction with safety-related SSCs.

LRA Table 2.4-17 identifies the components subject to an AMR for the component supports commodity group by component type and intended function.

2.4.17.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the component supports commodity group SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.18 Substation structures

2.4.18.1 Summary of Technical Information in the Application

LRA Section 2.4.18 describes the substation structures, which include the substation relay house and the structural steel support structures for the two auxiliary transformers and those associated with buses 04 and 08 including the first circuit breakers upstream of the 1A and 1B Auxiliary and Main Transformers. The substation structures are located east of the turbine building.

The substation structures include the substation relay house, the foundations for the auxiliary transformers, and the foundations and miscellaneous structural steel for supporting high voltage insulators, transmission conductors and switchyard bus associated with buses 04 and 08 including the first circuit breakers upstream of the 1A and 1B auxiliary and main transformers.

The substation relay house is a single story above grade structure with reinforced concrete below grade walls and is located east of the turbine building.

LRA Table 2.4-18 identifies the components subject to an AMR for the substation structures by component type and intended function.

2.4.18.2 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the substation structures SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.19 Turbine Building

2.4.19.1 Summary of Technical Information in the Application

LRA Section 2.4.19 describes the turbine building which includes the turbine building, heater bay, auxiliary boiler enclosure, and make-up waste neutralizer tank enclosure, which are all class III structures and are designed to withstand the effects of normal operating loads.

The turbine building and heater bay are multi-story steel-framed structures. The turbine building contains the turbine generator pedestal. The turbine building and heater bay are located east of the reactor building and Class III portion of the intermediate building, and north of the control building.

The auxiliary boiler enclosure is single-story, above-grade steel structure attached to the east wall of the turbine building. The make-up waste neutralizer tank enclosure is a single-story above grade steel structure attached to the southwest wall of the turbine building. The buildings included within the turbine building evaluation boundary house electrical and mechanical equipment required for safe operation of the plant, including steam and power conversion system components and supporting systems. Major components within the buildings include the turbine generators, main condensers, condensate pumps, main steam stop and control valves, moisture separators, reactor feedwater pumps, turbine building and heater bay heating and ventilation system, auxiliary boilers, and associated piping and makeup waste neutralizer tank.

The purpose of the buildings is to provide structural support, shelter, and protection for mechanical and electrical equipment required for safe operation of the plant, including safe shutdown of the reactor. Additionally, they provide structural support, shelter, and protection for electrical and mechanical equipment required for station blackout, fire protection, and anticipated transients without scram. The turbine building also provides shielding from post-accident radiation exposure to allow personnel access for operating and maintaining equipment.

LRA Table 2.4-19 identifies the components subject to an AMR for the turbine building by component type and intended function.

2.4.19.2 Staff Evaluation

The staff reviewed LRA Section 2.4.19 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.19, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the turbine building.

In RAI 2.4.19-1, dated August 22, 2008, the staff requested that the applicant provide additional information to clarify two seemingly contradictory statements from the LRA and the UFSAR regarding the turbine building. The LRA stated that the turbine building provided support and shelter to "…mechanical and electrical equipments required for safe operation of the plant, including safe shutdown of the reactor." Section 5.1.1.3 of the UFSAR lists the turbine building as a class III structure. By definition noted in the UFSAR, class III SSCs are not related to reactor operation. Furthermore, Section 5.4.3.2.5 of the UFSAR states, "There is no equipment located in the turbine building that is required for safe shutdown of the plant."

In its response to the RAI, dated September 19, 2008, the applicant stated that the turbine building is a class III structure that houses safety-related equipment. By the standard of 10 CFR 54.4(a)(2), the turbine building is within the scope of license renewal. Furthermore, the need for clarification of the contradictory statements was entered into its corrective action program.

Based on its review, the staff finds the response to RAI 2.4.19-1 acceptable because the turbine building was determined to be within the scope of license renewal as required by 10 CFR 54.4(a)(2). Furthermore, the applicant entered the contradictory statements into its corrective action program for resolution. The staff's concern described in RAI 2.4.19-1 is resolved.

2.4.19.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the turbine building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.20 UPS Diesel Building

2.4.20.1 Summary of Technical Information in the Application

LRA Section 2.4.20 describes the UPS diesel building which is a single story above grade steel framed structure located adjacent to the north wall of the service building.

The building houses the security inverter which is required for support of ATWS and also houses the UPS diesel generator and associated electrical and mechanical equipment.

The purpose of the building is to provide structural support, shelter and protection for electrical equipment required for ATWS. Additionally, the structure provides structural support, shelter and protection for electrical equipment required for normal plant operations and for electrical and mechanical equipment required to provide back-up power for security. LRA Table 2.4-20 identifies the components subject to aging management review for the UPS diesel building by component type and intended function.

2.4.20.2 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the UPS diesel building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical Systems/Commodity Groups

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

- 2.5.1 Electrical Systems
- 2.5.2 Electrical Commodity Groups

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

The staff's evaluation of the information provided in the LRA was performed in the same manner for all electrical system and electrical commodity group components. The objective of the review was to determine if electrical system and electrical commodity group components that appeared to meet the scoping criteria specified in the Rule were identified by the applicant as within the scope of license renewal in accordance with 10 CFR 54.4. Similarly, the staff evaluated the applicant's screening results to verify that all long-lived passive components were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

To perform its evaluation, the staff reviewed the applicable LRA section and associated drawings, focusing its review on components that had not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each electrical system and electrical commodity group component to determine if the applicant had omitted components with intended functions delineated under 10 CFR 54.4(a) from the scope of license renewal. The staff also reviewed the licensing basis documents to determine if all intended functions delineated under 10 CFR 54.4(a) were specified in the LRA. If omissions were identified, the staff requested additional information to resolve the discrepancies.

Once the staff completed its review of the scoping results, the staff evaluated the applicant's screening results. For those systems and components with intended functions, the staff sought to determine (1) if the functions are performed with moving parts or a change in configuration or properties, or (2) if they are subject to replacement based on a qualified life or specified time period as described in 10 CFR 54.21(a)(1). For those that failed to meet either of these criteria, the staff sought to confirm that these electrical system and electrical commodity group components were subject to an AMR as required by 10 CFR 54.21(a)(1). If discrepancies were identified, the staff requested additional information to resolve them.

LRA Section 2.5.2.5 identifies the structures and components of the electrical systems that are subject to an AMR for license renewal.

The applicant described the supporting structures and components of the electrical systems in the following sections of the LRA:

- 2.5.1.1 120 V Vital Power System
- 2.5.1.2 250/125 VDC System
- 2.5.1.3 4160 V Auxiliary System
- 2.5.1.4 480 V Auxiliary System
- 2.5.1.5 6900 V Auxiliary System
- 2.5.1.6 Communication System
- 2.5.1.7 Digital Turbine Control System
- 2.5.1.8 Electrical Heat Tracing System
- 2.5.1.9 Engineered Safeguards Actuation System (ESAS)
- 2.5.1.10 Heat Sink Protection System
- 2.5.1.11 Integrated Control System
- 2.5.1.12 Lighting System
- 2.5.1.13 Main and Auxiliary Transformers
- 2.5.1.14 Non-Nuclear Instrumentation and Monitoring System
- 2.5.1.15 Nuclear Instrumentation and Incore Monitoring System
- 2.5.1.16 Reactor Protection and Control Rod Drive System
- 2.5.1.17 Remote Shutdown Panel
- 2.5.1.18 Substation

In LRA Section 2.5.2, the applicant described the screening process for electrical commodity groups and then described them in the following sections of the LRA:

- 2.5.2.5.1 Insulated Cables and Connections
- 2.5.2.5.2 Metal Enclosed Bus
- 2.5.2.5.3 Fuse Holders
- 2.5.2.5.4 Cable Connections

- 2.5.2.5.5 Connector Contacts for Electrical Connectors Exposed to Borated Water Leakage
- 2.5.2.5.6 Electrical Penetrations
- 2.5.2.5.7 High Voltage Insulators
- 2.5.2.5.8 Transmissions Conductors and Connections; Switchyard Bus and Connections

The staff's review findings regarding LRA Sections 2.5.1.1–2.5.1.18, and Sections 2.5.2.5.1–2.5.2.5.8 are presented in SER Section 2.5.1.

2.5.1 Electrical and Instrumentation and Controls Systems

2.5.1.1 Summary of Technical Information in the Application

LRA Section 2.5.1 describes the electrical and I&C systems. The scoping method includes all plant electrical and I&C components. Evaluation of electrical systems includes electrical and I&C components in mechanical systems. The plant spaces approach for the review of plant environments eliminates the need to indicate each unique component and its specific location and precludes improper exclusion of components from an AMR.

LRA Table 2.5-1 identifies electrical and I&C systems component types and their intended functions within the scope of license renewal and subject to an AMR:

- Cable Connections (Metallic Parts)-Electrical Continuity
- Connector Contacts for Electrical Connectors Exposed to Borated Water Leakage--Electrical Continuity
- Fuse Holders-Electrical Continuity
- High Voltage Insulators-Insulation / Electrical
- Insulated Cables and Connections-Electrical Continuity
- Insulated Cables and Connections Used in Instrumentation Circuits-Electrical Continuity
- Insulated Inaccessible Medium Voltage Cables-Electrical Continuity
- Metal enclosed bus-Electrical Continuity
- Metal enclosed bus-Insulation / Electrical
- Metal enclosed bus-Shelter/ Protection
- Switchyard Bus and Connections-Electrical Continuity
- Transmission Conductors and Connections-Electrical Continuity

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, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems."

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

There has been operating experience regarding the failure of cable tie-wraps caused by the age-related brittleness of the plastic material. These cable tie-wraps would be considered long-lived passive components depending on whether or not they have a credited design function. Some possible intended design functions include maintaining spacing for power cable ampacity, maintaining stiffness in unsupported lengths of wire bundles to ensure minimum bending radius, and maintaining cables within vertical raceways. Most recently, at Point Beach, the regional inspectors identified an unresolved item (Inspection Report 05000266/2006006; 05000301/2006006) after noticing that the current configuration of the plant may not be consistent with plant design documents due to the age-related breakage of a large number of plastic tie-wraps used to fasten wires and cables. At Point Beach, cable tie-wraps are part of the cable design to maintain cable ampacity, or are credited in the applicant's Seismic Qualifications Utility Group documents to seismically qualify the cable tray system.

In RAI 2.5.1, dated August 22, 2008, the staff requested that the applicant provide additional information to explain how it manages the aging of cable tie-wraps if they are credited in the plant design basis. In addition, the applicant was to justify why the cable tie-wraps were not included within the scope of license renewal in accordance with the requirements of 10 CFR 54.4.

The staff evaluated the LRA, the UFSAR, and the applicant's response to the RAI, dated September 19, 2008 and determined that while tie-wraps are used in cable installations, there are no CLB requirements that cable tie-wraps remain functional during and following DBEs. Cable tie-wraps are not credited for maintaining cable ampacity, ensuring maintenance of cable minimum bending radius, or maintaining cables within vertical raceways. The seismic qualification of cable trays does not credit the use of cable tie-wraps. Cable tie-wraps are not credited in the design basis in terms of any 10 CFR 54.4 intended function. Therefore, cable tie-wraps are not within the scope of license renewal and are therefore not subject to aging management review. The staff's concern described in RAI 2.5.1 is resolved.

General Design Criteria 17 of 10 CFR Part 50, Appendix A, requires that electric power from the transmission network to the onsite electric distribution system 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 a letter dated April 1, 2002 (ADAMS Accession No. ML020920464), "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))," and later incorporated in SRP-LR Section 2.5.2.1.1, 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 includes the complete circuits between the onsite circuits and up to and including the first circuit breakers in the substation (which includes the substation circuit breakers' associated controls and structures) within the scope of license renewal. In Section 2.1.3.4, the applicant states that the boundary between the transmission system and the plant electrical system is the first 230 KV breakers upstream of the 1A and 1B Auxiliary and Main Transformers. Consequently, the staff concludes that the scoping is consistent with the guidance issued April 1, 2002. This guidance was subsequently incorporated in SRP-LR, Section 2.5.2.1.1.

2.5.1.3 Conclusion

The staff reviewed the LRA, the RAI response, and the UFSAR to determine if the applicant failed to identify any SSCs within the scope of license renewal. The staff has found no such omissions. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the electrical and I&C systems components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.6 Conclusion for Scoping and Screening

The staff reviewed the information in LRA Section 2, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results." The staff finds that the applicant's scoping and screening methodology is consistent with the requirements of 10 CFR 54.21(a)(1), and the staff's position on the treatment of safety related and non-safety related SSCs within the scope of license renewal and the SCs requiring an AMR are 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 that are within the scope of license renewal as required by 10 CFR 54.4(a), and those systems and components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

With regard to these matters, the staff concludes that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and any changes made to the CLB, to comply with 10 CFR 54.21(a)(1), are in accordance with the NRC's 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 Three Mile Island Nuclear Station, Unit 1 (TMI-1), by the staff of the United States Nuclear Regulatory Commission (NRC or the staff).

In Appendix B of its license renewal application (LRA), AmerGen Energy Company, LLC (AmerGen or the applicant) described the 38 AMPs it relies on to manage or monitor the aging of passive and 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 <u>Applicant's Use of the Generic Aging Lessons Learned Report</u>

In preparing its LRA, the applicant credited NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 1, dated September 2005. The GALL Report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the period of extended operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular SCs for license renewal without change. 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 the programs at its facility correspond to those reviewed and approved in the GALL Report.

The purpose of the GALL Report is to provide the staff with 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 used to review an applicant's LRA will be greatly reduced, thereby improving the efficiency and effectiveness of the license renewal review process. The GALL Report also serves as a reference for applicants and staff reviewers to quickly identify those AMPs and activities that the staff has determined will adequately manage or monitor aging during the period of extended operation.

The GALL Report identifies: (1) systems, structures, and components (SSCs), (2) SC materials, (3) environments to which the SCs are exposed, (4) the aging effects associated with the materials and environments, (5) the AMPs credited with managing or monitoring the aging effects, and (6) recommendations for further applicant evaluations of aging management for certain component types.

The staff performed its review in accordance with the requirements of Title 10, Part 54 of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plant" (SRP-LR), Revision 1, dated September 2005, and the guidance provided in the GALL Report.
In addition to its review of the LRA, the staff conducted an onsite audit of selected AMRs and associated AMPs during the weeks of July 14 and July 28, 2008, respectively, as described in the

"Audit Report Regarding the Three Mile Island Nuclear Station, Unit-1, License Renewal Application," dated November 24, 2008. 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, the need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in review efficiency.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that followed the standard LRA format, as determined by the NRC and the Nuclear Energy Institute (NEI) by letter dated April 7, 2003. This LRA format incorporates lessons learned from the staff's reviews of previous LRAs which used a format developed from information gained during a staff-NEI demonstration project conducted to evaluate the use of the GALL Report in the LRA review process.

The organization of LRA Section 3 parallels Chapter 3 of the SRP-LR. The AMR results information in LRA Section 3 is presented in the following two table types:

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

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

The content of the previous applications and the TMI-1 application are essentially the same. The intent of the format used for the TMI-1 LRA was to modify the tables in Chapter 3 to provide additional information that would assist the staff in its review. In each Table 1, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In each Table 2, the applicant identified the linkage between the scoping and screening results in Chapter 2 and the AMRs in Chapter 3.

3.0.1.1 Overview of Table 1s

Table 3.3.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables of the GALL Report. The table is essentially the same as Tables 1 through 6 provided in the GALL Report, Volume 1, except that the "Type" column has been replaced by an "Item Number" column and the "Related Generic Item" and "Unique Item" columns have been replaced by a "Discussion" column. The "Discussion" column is used by the applicant to provide clarifying and amplifying information. The following are examples of information that might be contained within this column:

- further evaluation is documented in subsection x
- see subsection x
- exceptions to the GALL Report assumptions

- discussion of how the line is consistent with the corresponding line item in the GALL Report when this consistency may not be intuitively obvious
- discussion of how the item is different from the corresponding line item in the GALL Report (e.g., when there is exception taken to a GALL AMP)

The format of Table 1 allows the staff to align a specific Table 1 row with the corresponding GALL Report table row so that the consistency can be checked easily.

3.0.1.2 Overview of Table 2s

Each Table 3.3.2-y (Table 2) provides the detailed results of the AMRs 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, engineered safety features, auxiliary systems, etc.). For example, the engineered safety features 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 identifies the component types from LRA Section 2 subject to an AMR. The component types are listed in alphabetical order.

(2) Intended Function – The second column contains the license renewal intended functions for the listed component types. Definitions of intended functions are contained in LRA Table 2.1-1.

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

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

(5) Aging Effect Requiring Management – The fifth column lists aging effects requiring management (AERMs). As part of the AMR process, the applicant determined any AERMs for each combination of material and environment.

(6) Aging Management Programs – The sixth column lists the AMPs that the applicant used to manage the identified aging effects.

(7) GALL Report Volume 2 Line Item – The seventh column lists the GALL Report item(s) that the applicant identified as similar to the AMR results in the LRA. The applicant compared each combination of component type, material, environment, AERM, and AMP in Table 2 of the LRA to the items in the GALL Report. If there were no corresponding items in the GALL Report, the applicant left the column blank. In this way, the applicant identified the AMR results in the LRA tables that corresponded to the items in the GALL Report tables.

(8) Table 1 Item – The eighth column lists the corresponding summary item number from Table 1. If the applicant identifies AMR results in Table 2 that are consistent with the GALL Report, then the associated Table 3.x.1 line summary item number should be listed in Table 2. If there is no corresponding item in the GALL Report, then column eight is left blank. That way, the information from the two tables can be correlated.

(9) Notes – The ninth column lists the corresponding notes that the applicant used to identify how the information in Table 2 aligns with the information in the GALL Report. The notes identified by letters were developed by an NEI working group and will be used in future LRAs. Any plant-specific notes are identified by a number and provide additional information concerning the consistency of the line 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 associated AMPs:

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

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

(3) For other items, the staff conducted a technical review pursuant to 10 CFR 54.21(a)(3).

These audits and technical reviews determine whether the effects of aging on SCs can be adequately managed so that the intended functions can be maintained 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: The scope of program should include the specific SCs subject to an AMR for license renewal.

(2) Preventive Actions: Preventive actions should prevent or mitigate aging degradation.

(3) Parameters Monitored or Inspected: Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended function(s).

(4) Detection of Aging Effects: Detection of aging effects including such aspects as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new/one-time inspections should occur before there is a loss of structure or component intended function(s).

(5) Monitoring and Trending: Monitoring and trending should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) Acceptance Criteria: Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all CLB design conditions during the period of extended operation.

(7) Corrective Actions: Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) Confirmation Process: Confirmation process should ensure that preventive actions are adequate and that appropriate and effective corrective actions have been completed.

(9) Administrative Controls: Administrative controls should provide a formal review and approval process.

(10) Operating Experience: Operating experience of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the SC intended functions 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 Aging Management Program Audit Report and summarized in SER Section 3.0.3.

The staff reviewed the applicant's corrective action program and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the corrective actions program included assessment of the following program elements: (7) "corrective actions," (8) "confirmation process," and (9) "administrative controls."

The staff reviewed the updated final safety analysis report (UFSAR) supplement for each AMP to determine if it provided an adequate description of the program or activity, as required by 10 CFR 54.21(d).

3.0.2.2 Review of AMR Results

Table 2 contains information concerning whether the AMRs align with the AMRs identified in the GALL Report. For a given AMR in Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP combination for a particular component type within a system. The AMRs that correlate between a combination in Table 2 and a combination in the GALL Report were identified by a referenced item number in column seven, "NUREG-1801 Volume 2 Line Item." The staff also conducted onsite audits to verify the correlation. A blank column seven indicates that the applicant was unable to locate an appropriate corresponding combination in the GALL Report. The staff conducted a technical review of these combinations not consistent with the GALL Report. The next column, "Table 1 Item," provides a reference number that indicates the corresponding row in Table 1.

3.0.2.3 UFSAR Supplement

Consistent with the SRP-LR, for the AMRs and associated AMPs that it reviewed, the staff also reviewed the UFSAR Supplement that summarizes the applicant's programs and activities for managing the effects of aging 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, SRP-LR, and GALL Report. Also, 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 3.0.3 – 1 below presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the GALL Report AMP that the applicant claimed its AMP was consistent with, if applicable, and the SSCs for managing or monitoring aging. The section of the SER, in which the staff's evaluation of the program is documented, is also provided.

Table 3.0.3 – 1 TMI-1 Aging Management Programs

Applicant Aging Management Program	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report Aging Management Programs	SER Section
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	A.2.1.1 B.2.1.1	Existing	Consistent with Exceptions	XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	3.0.3.2.1
Water Chemistry	A.2.1.2 B.2.1.2	Existing	Consistent with Enhancement	XI.M2, "Water Chemistry"	3.0.3.2.2
Reactor Head Closure Studs	A.2.1.3 B.2.1.3	Existing	Consistent with Exceptions	XI.M3, "Reactor Head Closure Studs"	3.0.3.2.3
Boric Acid Corrosion Program	A.2.1.4 B.2.1.4	Existing	Consistent	XI.M10, "Boric Acid Corrosion	3.0.3.1.1
Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	A.2.1.5 B.2.1.5	Existing	Consistent	XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors"	3.0.3.1.2
Flow Accelerated Corrosion Program	A.2.1.6 B.2.1.6	Existing	Consistent with Exception	XI.M17, "Flow Accelerated Corrosion"	3.0.3.2.4

Applicant Aging Management Program	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report Aging Management Programs	SER Section
Bolting Integrity Program	A.2.1.7 B.2.1.7	Existing	Consistent	XI.M18, "Bolting Integrity"	3.0.3.1.3
Steam Generator Tube Integrity Program	A.2.1.8 B.2.1.8	Existing	Consistent	XI.M19, "Steam Generator Tube Integrity"	3.0.3.1.4
Open Cycle Cooling Water Program	A.2.1.9 B.2.1.9	Existing	Consistent with Exception and Enhancement	XI.M20, "Open-Cycle Cooling Water System"	3.0.3.2.5
Closed Cycle Cooling Water Program	A.2.1.10 B.2.1.10	Existing	Consistent with Exception and Enhancement	XI.M21, "Closed Cycle Cooling Water System"	3.0.3.2.6
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	A.2.1.11 B.2.1.11	Existing	Consistent with Enhancements	XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	3.0.3.2.7
Compressed Air Monitoring Program	A.2.1.12 B.2.1.12	Existing	Consistent with Enhancements	XI.M24, "Compressed Air Monitoring"	3.0.3.2.8
Fire Protection Program	A.2.1.13 B.2.1.13	Existing	Consistent with Exception and Enhancements	XI.M26, "Fire Protection"	3.0.3.2.9
Fire Water System	A.2.1.14 B.2.1.14	Existing	Consistent with Enhancements	XI.M27, "Fire Water System"	3.0.3.2.10
Aboveground Steel Tanks	A.2.1.15 B.2.1.15	Existing	Consistent with Exception and Enhancements	XI.M29, "Aboveground Steel Tanks"	3.0.3.2.11
Fuel Oil Chemistry	A.2.1.16 B.2.1.16	Existing	Consistent with Exceptions and Enhancements	XI.M30, "Fuel Oil Chemistry"	3.0.3.2.12
Reactor Vessel Surveillance	A.2.1.17 B.2.1.17	Existing	Consistent with enhancements	XI.M31, "Reactor Vessel Surveillance"	3.0.3.2.13
One-Time Inspection Program	A.2.1.18 B.2.1.18	New	Consistent with Exception	XI.M32, "One-Time Inspection"	3.0.3.2.14
Selective Leaching of Materials	A.2.1.19 B.2.1.19	New	Consistent	XI.M33, "Selective Leaching of Materials"	3.0.3.1.5
Buried Piping and Tanks Inspection	A.2.1.20 B.2.1.20	Existing	Consistent with Exceptions and Enhancements	XI.M34, "Buried Piping and Tanks Inspection"	3.0.3.2.15
External Surfaces Monitoring	A.2.1.21 B.2.1.21	New	Consistent with Exception	XI.M36, "External Surfaces Monitoring"	3.0.3.2.16
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	A.2.1.22 B.2.1.22	New	Consistent with Exceptions	XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	3.0.3.2.17

Applicant Aging Management Program	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report Aging Management Programs	SER Section
Lubricating Oil Analysis	A.2.1.23 B.2.1.23	Existing	Consistent with Exception	XI.M39, “Lubricating Oil Analysis”	3.0.3.2.18
ASME Section XI, Subsection IWE	A.2.1.24 B.2.1.24	Existing	Consistent with Exception	XI.S1, “ASME Section XI, Subsection IWE”	3.0.3.2.19
ASME Section XI, Subsection IWL	A.2.1.25 B.2.1.25	Existing	Consistent	XI.S2, “ASME Section XI, Subsection IWL”	3.0.3.1.6
ASME Section XI, Subsection IWF	A.2.1.26 B.2.1.26	Existing	Consistent with Exception	XI.S3, “ASME Section XI, Subsection IWF”	3.0.3.2.20
10 CFR 50, Appendix J	A.2.1.27 B.2.1.27	Existing	Consistent	XI.S4, “10 CFR 50 Appendix J”	3.0.3.1.7
Structures Monitoring Program	A.2.1.28 B.2.1.28	Existing	Consistent with Enhancements	XI.S6, “Structures Monitoring Program”	3.0.3.2.21
Protective Coating Monitoring and Maintenance Program	A.2.1.29 B.2.1.29	Existing	Consistent	XI.S8, “Protective Coating Monitoring and Maintenance Program”	3.0.3.1.8
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A.2.1.30 B.2.1.30	New	Consistent	XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.9
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	A.2.1.31 B.2.1.31	Existing	Consistent with Enhancement	XI.E2, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits”	3.0.3.2.22
Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A.2.1.32 B.2.1.32	New	Consistent	XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.10
Metal Enclosed Bus	A.2.1.33 B.2.1.33	Existing	Consistent with Enhancement	XI.E4, “Metal Enclosed Bus”	3.0.3.2.23

Applicant Aging Management Program	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report Aging Management Programs	SER Section
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A.2.1.34 B.2.1.34	New	Consistent with Exceptions	XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	3.0.3.2.24
Nickel Alloy Aging Management Program	A.2.2.1 B.2.2.1	Existing	Plant Specific	XI.M11A, "Nickel Alloy Aging Management Program"	3.0.3.3.1
Metal Fatigue of Reactor Coolant Pressure Boundary	A.3.1.1 B.3.1.1	Existing	Consistent with Enhancement	X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary"	3.0.3.2.25
Concrete Containment Tendon Prestress	A.3.1.2 B.3.1.2	Existing	Consistent with Exception	X.S1, "Concrete Containment Tendon Prestress"	3.0.3.2.26
Environmental Qualification (EQ) of Electrical Components	A.3.1.3 B.3.1.3	Existing	Consistent	X.E1, "Environmental Qualification (EQ) of Electric Components"	3.0.3.1.11

3.0.3.1 AMPs That Are Consistent with the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as being consistent with the GALL Report:

- Boric Acid Corrosion
- Nickel Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors
- Bolting Integrity
- Steam Generator Tube Integrity
- Selective Leaching of Materials
- ASME Section XI, Subsection IWL
- 10 CFR Part 50, Appendix J
- Protective Coating Monitoring and Maintenance Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Environmental Qualification of Electric Components

3.0.3.1.1 Boric Acid Corrosion

Summary of Technical Information in the Application. LRA Section B.2.1.4 describes the existing Boric Acid Corrosion Program as being consistent with GALL AMP XI.M10, "Boric Acid Corrosion."

The applicant stated that the program includes provisions to identify, inspect, examine and evaluate leakage, and initiate corrective action, and relies in part on implementation of recommendations of NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Components in PWR plants" and also includes visual examinations of Alloy 600 components for stress corrosion cracking due to boric acid leakage.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the applicant's license renewal basis document and determined that the program scope includes the systems and components that could be affected by boric acid corrosion.

In comparing the program elements in the applicant's program to those in the GALL AMP XI.M10, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.M10, but also identified an issue with the "scope of program" program element for which the staff requested additional information.

The staff could not determine whether all the components, including all Class 1 nickel alloy locations as per NRC Order EA-03-009, Bulletins 2003-02 and 2004-01, were included in the "scope of the program" element for visual inspection. In RAI B.2.1.4-1, dated September 29, 2008, the staff requested that the applicant provide the following information:

(a) Clarification as to which components are included within the scope of the AMP, and whether the scope includes all Class 1 nickel alloy locations

(b) For in-scope nickel alloy locations (if any), clarification of whether or not the examinations will be implemented through this AMP or another AMP discussed in the LRA. If another AMP will be used for specific components, clarification as to which AMP will be implemented for the examination

(c) Clarification as to which programs will be used to evaluate the evidence of leakage that is detected through the AMP or other AMPs

(d) For the in-scope nickel-alloy components, clarification of what type of visual examinations (i.e., specify whether VT-1, VT-2 or VT-3, and whether the visual examinations are enhanced, bare-surface, qualified, etc.) will be performed on the components

In its response dated October 20, 2008, the applicant stated that components and structures included in the scope of the Boric Acid Corrosion Program include all components from which borated water can leak and all structures and components within the vicinity of potential borated water leakage, which includes all components within the Reactor, Auxiliary, and Fuel Handling

Buildings. The applicant also stated that Class 1 nickel alloy components located in these buildings are included in the scope of the program.

The applicant further stated that for in-scope nickel alloy locations, visual inspections are performed under the “Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors” program, (B.2.1.5), or the “Nickel Alloy Aging Management Program,” (B.2.2.1) by using UT-2 qualified personnel. The applicant also stated that both these programs and the Boric Acid Corrosion Program direct inspections, however, evaluations of borated water leakage, regardless of which program detected the leak, are performed under the Boric Acid Corrosion program. The applicant also stated that the visual examinations are consistent with the requirements of 10 CFR 50.55a and recommendations of Code Cases N-722 and 729-1.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.4-1 acceptable because the applicant clarified the scope of the program, indicated which program performs the visual examinations for the nickel alloy components, and confirmed that evaluations of any borated water leakage is performed under the Boric Acid Corrosion Program. The staff’s concern described in RAI B.2.1.4-1 is resolved.

The staff confirmed that in the LRA, the applicant’s AMR line item results for applicable Table 2 items credits the Boric Acid Corrosion Program to manage loss of material due to boric acid corrosion in steel, copper alloy, and aluminum alloy component surfaces and concrete structures that may be potentially exposed to leakage from borated water systems.

Based on its review, the staff finds the applicant’s Boric Acid Corrosion Program consistent with the program elements of GALL AMP XI.M10, “Boric Acid Corrosion Program,” and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.4 and also interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff reviewed the “operating experience” discussion in the applicant’s license renewal basis document for the Boric Acid Corrosion Program and also a sample of condition reports and confirmed that the applicant identified boric acid corrosion and implemented appropriate corrective actions.

The “operating experience” program element for LRA Section B.2.1.4 states that in November 2006 an active borated water leak was identified dripping from a reactor coolant valve threaded fitting. The applicant stated that corrective actions were initiated by having the fitting repaired and the area cleaned and that no degradation was identified at the time. The applicant also stated that the fitting was subsequently inspected and no leakage was identified. The applicant also stated that wet boron buildup was discovered in November 2006 on a differential pressure transmitter and other components within the immediate vicinity and that the general area where the boric acid leak was occurring was inspected and no corrosion was observed. The applicant stated that the leak from the relief valve was repaired and the general areas cleaned. The applicant also stated that periodic self-assessments of the Boric Acid Corrosion Program are performed to identify the areas that need improvement to maintain the quality of the program.

Based on its review, the staff finds that the applicant has demonstrated that its Boric Acid Corrosion Program is capable of identifying, monitoring, and correcting the effects of boric acid corrosion on the intended function of components that may be exposed to borated water leakage, because the staff has confirmed that the program is consistent with the recommendations in GALL AMP XI.M10 and the program is updated to account for relevant operating experience. The staff finds that the Boric Acid Corrosion Program can be expected to ensure that the systems and components within the scope of the program will continue to perform their intended functions consistent with the CLB for the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.4, provides the applicant's UFSAR Supplement for the Boric Acid Corrosion Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in SRP LR Table 3.1-2.

In LRA Section A.5, Commitment No. 4, the applicant committed to implement the Boric Acid Corrosion Program on an on-going basis during the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Boric Acid Corrosion Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Boric Acid Corrosion Program and the applicant's response to the RAI, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.2 Nickel Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors

Summary of Technical Information in the Application. LRA Section B.2.1.5 describes the existing Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program as being consistent to GALL AMP XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors."

The applicant stated that this program has been established to ensure that augmented inservice inspections (ISI) of all nickel alloy vessel head penetration (VHP) nozzles welded to the upper reactor vessel (RV) head will continue to be performed as mandated by the interim requirements of NRC Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (PWRs)," as amended by the First Revision of the Order, or by any subsequent NRC requirements that may be established to supersede the requirements of the Order.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in the GALL AMP XI.M11A, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.M11A. The staff determined that the applicant committed to comply with all NRC Orders including bare head and non-destructive inspection at appropriate intervals, adhere to water chemistry guidelines, establish primary water stress corrosion cracking (PWSCC) susceptibility ranking and flaw evaluation, and establish repair and replacement procedures in accordance with NRC-approved American Society of Mechanical Engineers (ASME) Section XI Boiler and Pressure Vessel Code methods.

The staff noted that revisions to 10 CFR 50.55a, "Codes and Standards" were issued in September of 2008, that change the requirements for inspection of nickel alloy welds. The applicant's LRA does not address the revisions to 10 CFR 50.55a because it was submitted in January 2008. The staff discussed this issue with the applicant who indicated in an e-mail dated January 14, 2009, that one of the changes impacts the AMP and that the changes have been incorporated in an interim revision to its ISI Program. The applicant further indicated that its scheduling database has been updated to reflect the inspection requirements of ASME Code Case N-729-1 and that a visual inspection is scheduled for Outage 1R19 (in 2011) and that a non-destructive examination (NDE) has been scheduled for outage 20R (in 2013) both of which are in accordance with 10 CFR 50.55a and Code Case N-729-1 through the 2013 refueling outage.

The applicant further indicated that the changes do not impact the text in the LRA describing the program and that the text will only slightly change based on the revised requirements. The applicant further indicated that the changes are scheduled to be completed by April 30, 2009 and that the changes will not be identified as exceptions to GALL AMP XI.M11A which is considered acceptable based on the discussion provided in the Federal Register Notice when the rule was revised. During a phone conversation on June 29, 2009, the applicant indicated that the changes identified above have been completed. Based on its review, the staff finds the applicant's implementation of the provisions of 10 CR 50.55a and ASME Code Case N-729-1, acceptable.

Based on its review, the staff finds the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program consistent with the program elements of GALL AMP XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.5 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. Furthermore, the staff confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the effects of aging are effectively managed through objective evidence that shows that PWSCC of upper VHP nozzles is being adequately managed. The staff determined that the LRA provides examples of operating experience that provide objective evidence that the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation. The

LRA states that during the first refueling outage (Fall 2005) after head replacement (with PWSCC resistant nozzles) in 2003, a one hundred % bare metal and control rod drive (CRD) flange visual inspection detected minor staining and boron film deposits, but no corrosion of the head was detected. The cause of the deposits was a leaking bolted CRD flange connection and not PWSCC.

The staff determined that the documentation provided by the applicant during the onsite review supported the applicant's statements regarding operating experience and confirms that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.5, provides the applicant's UFSAR Supplement for the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in SRP-LR, Table 3.1-2.

In LRA Section A.5, Commitment No. 5, the applicant committed to the continued implementation of the existing Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program during the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.3 Bolting Integrity

Summary of Technical Information in the Application. LRA Section B.2.1.7 describes the existing Bolting Integrity Program as being consistent with GALL AMP XI.M18, "Bolting Integrity."

The applicant stated that the program manages the loss of material due to general, pitting and crevice corrosion, microbiologically-influenced corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening, by incorporating NRC and industry recommendations in NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," and EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants."

The applicant stated that the program is supplemented by several other AMPs which carry out the specifications identified in the program. The supplemental programs include the Structures

Monitoring Program, ASME Section XI Subsection IWE, ASME Section XI Subsection IWF, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, and External Surfaces Monitoring Programs.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL report. The staff also interviewed the applicant's technical staff and reviewed on-site documents.

In comparing the program elements in the applicant's program to those in GALL AMP XI.M.18, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.M18, but also identified a possible exception to the "monitoring and trending" program element. The staff determined that the GALL recommendation concerning leak rate to be monitored on a particularly defined schedule was not specifically addressed in the applicant's program, and questioned whether it should be identified as an exception. In RAI B.2.1.7-1, dated October 7, 2008, the staff requested the applicant provide additional information on the applicant's leak rate monitoring schedule.

In its response to the RAI, dated October 30, 2008, the applicant stated that it agrees with the staff's position that the leak rate monitoring issue should be identified as an exception to the GALL Report "monitoring and trending" program element. The applicant submitted this exception crediting its current corrective action program and leak detection process for meeting the recommendations of the GALL Report "monitoring and trending" program element.

Furthermore, the applicant stated that in cases of leakage on bolting connections for pressure retaining components (not covered by ASME Section XI), the inspection frequency is determined by engineering evaluation of the problem through the corrective action program. The applicant stated that this is achieved through the use of periodic engineering walkdowns and equipment maintenance activities. Once a leak is identified, the issue is documented in the corrective action program and frequency of follow up inspections is assigned based on the evaluation of the problem. The applicant further stated that, for any leak, an evaluation is completed to determine the actions required based on the severity of the leak and the potential to impact normal operations and safety. Furthermore, if the leak rate changes, further evaluation is performed to determine the actions required.

Based on its review, the staff finds the applicant's response to RAI B.2.1.7-1 acceptable because the applicant submitted an exception to the GALL Report crediting its current corrective action program and leak detection process for meeting the recommendation of GALL AMP XI.M18 "monitoring and trending" program element. The staff also finds the exception acceptable. The staff's concern described in RAI B.2.1.7-1 is resolved.

The staff noted that the Bolting Integrity Program is implemented through plant procedures that are based on NRC approved guidance and that inspections are conducted to manage the loss of material due to general, pitting and crevice corrosion, microbiologically-influenced corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening.

Based on its review, the staff finds the applicant's Bolting Integrity Program consistent with the program elements of GALL AMP XI.M18, "Bolting Integrity," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.7 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the operating experience related to Bolting Integrity did not show an adverse trend in performance. Furthermore, the applicant stated that all cases of bolting degradation were identified and corrective actions were implemented prior to loss of system intended functions.

The staff reviewed operating experience reports, including a sample of issue reports. In one report, the applicant stated that an event occurred in 2002, where loose nuts were discovered on the decay heat removal pump. The staff determined that proper corrective actions were taken to address the issue, including an action requiring the inspection of a sample of safety related and non safety related bolts or nuts. Additionally, an event occurred in 2005 where leakage was found on the exhaust manifold of the diesel generator. A faulty gasket led to improper closure, and as a result engine oil was found to be leaking from the exhaust manifold cover. The staff determined that proper corrective actions were taken to address the issue, including initiatives to determine the cause of the failure, multiple actions to correct the issue, and proper monitoring.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.7 provides the applicant's UFSAR Supplement for the Bolting Integrity Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 7, the applicant committed to the ongoing implementation of the Bolting Integrity Program on an on-going basis during the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Bolting Integrity Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Bolting Integrity Program and the applicant's response to the RAI, the staff finds those program elements the applicant claimed consistency with the GALL report, are consistent. The staff reviewed the response to the RAI and finds it acceptable. The staff confirmed a previously unidentified exception to the "monitoring and trending" program element concerning the applicant's leak rate monitoring schedule. The staff reviewed the exception and its justification and finds that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that 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 the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.4 Steam Generator Tube Integrity

Summary of Technical Information in the Application. LRA Section B.2.1.8 describes the existing Steam Generator Tube Integrity Program as being consistent with GALL AMP XI.M19, “Steam Generator Tube Integrity.”

The applicant stated that the program establishes the operation, maintenance, testing, inspection and repair of the steam generators to ensure that Technical Specification surveillance requirements, ASME Code requirements and the Maintenance Rule (10 CFR 50.65) performance criteria are met. The applicant also stated that the program provides for identifying, maintaining and protecting the steam generator design and licensing bases and implements NEI 97-06, “Steam Generator Program Guidelines,” which provides a framework for prevention, inspection, evaluation, repair and leakage monitoring measures.

The applicant also stated that it will replace the original Once-Through Steam Generators (OTSGs) with enhanced OTSGs prior to the period of extended operation and that this decision was made based on industry and plant experience with tube degradation. The applicant stated that the new OTSGs have improved design features including Alloy 690 tubes and will have a design life of 40 years, which along with the Steam Generator Tube Integrity Program will be effective in assuring that the intended functions will be maintained consistent with the CLB for the period of extended operation. The applicant stated that the Steam Generator Tube Integrity Program will continue when the new OTSGs are installed.

Staff Evaluation. During its review, the staff reviewed the applicant’s claim of consistency with the GALL Report.

In comparing the program elements in the applicant’s program to those in GALL AMP XI.M19, the staff determined that the applicant’s program elements are consistent with the recommendations of GALL AMP XI.M19.

GALL Report AMP XI.M19 recommends preventative measures to mitigate degradation phenomena, assessment of degradation mechanisms, inservice inspection of steam generator tubes to detect degradation, evaluation and plugging or repair, and leakage monitoring to maintain the structural and leakage integrity of the pressure boundary.

The LRA states that the program is also based upon NEI 97-06, which includes an assessment of degradation mechanisms and considers operating experience from similar steam generators to identify degradation mechanisms. For each mechanism, the EPRI guidelines associated with NEI 97-06 define the inspection techniques, measurement uncertainty, and the sampling strategy. EPRI guidelines associated with NEI 97-06 provide criteria for the qualification of personnel, specific techniques, and the associated acquisition and analysis of data. This includes procedures, probe selection, analysis protocols, and reporting criteria. The performance criteria in NEI 97-06 pertain to structural integrity, accident-induced leakage, and operational leakage. A Steam Generator Tube Integrity Program, as defined in NEI 97-06, includes guidance on assessment of degradation mechanisms, inspection, tube integrity assessment, maintenance, plugging, repair, leakage monitoring, and procedures for monitoring and controlling secondary-side and primary-side water chemistry. The staff finds the use of GALL AMP XI.M.19 and NEI 97-06 acceptable for managing aging of steam generator tubes and other components that can affect tube integrity.

Based on its review, the staff finds the applicant's Steam Generator Tube Integrity Program consistent with the program elements of GALL AMP XI.M19, “Steam Generator Tube Integrity.”

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.8. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the steam generators will be replaced prior to the period of extended operation. The applicant provided three examples of site-specific operating experience to demonstrate effectiveness of the program as follows:

(1) Widespread inside diameter intergranular attack (ID IGA) was identified in the early 1980s, mostly near the upper end of the OTSG tubing. The degradation was determined to have occurred during a chemistry excursion while the plant was in a shutdown condition. Repairs were performed using a kinetic expansion process that formed a new tube to tubesheet joint within the upper tubesheet. The repair was reviewed and approved by the NRC in 1983. Since that time, TMI-1 has specified inspection acceptance criteria and leakage assessment methodology for the TMI-1 OTSGs kinetic expansion joints that is unique to TMI-1. This inspection acceptance criteria and leakage assessment methodology has been reviewed and accepted by the NRC. During refueling outage 16 (Fall 2005), the kinetic expansion joints were inspected. These inspections found no growth of flaws in the kinetic expansion joints, and no trend of ongoing degradation due to ID IGA.

(2) TMI-1 will replace the OTSGs with enhanced OTSGs prior to the period of extended operation. This decision was made based on industry and TMI-1 experience with tube degradation. During refueling outage 16 (Fall 2005), 100 tubes in A OTSG and 106 tubes in B OTSG were plugged due to unacceptable indications. The inspections during this outage concluded that groove IGA, primary water stress corrosion cracking (PWSCC), outside diameter stress corrosion cracking (ODSCC) are active damage mechanisms. The results of TMI-1 tube inspections indicate increasing tube degradation and the probability of mid-cycle outages for inspection prior to the end of the current license. Currently, the A OTSG has 1661 plugged tubes and 247 sleeved tubes are in service. The B OTSG has 971 plugged tubes and 252 sleeved tubes are in service. The degradation mechanisms that have been identified historically in the current OTSGs include PWSCC, ID IGA, intergranular stress corrosion cracking (IGSCC), outside diameter intergranular attack (OD IGA), high cycle fatigue, OD SCC, tube-to-tube support plate wear fretting and severed plugged tube-to-tube wear. The new OTSGs will have a design life of 40 years, which along with the Steam Generator Tube Integrity program will be effective in assuring that the intended functions will be maintained consistent with the CLB for the period of extended operation.

(3) TMI-1 has incorporated a technical specification (TS) change to implement the requirements of Generic Letter 2006-01 and the associated alternative T S requirements for ensuring tube integrity. Generic Letter 2006-01 required that all PWRs implement the alternative TS requirements or submit a description of their program for ensuring tube integrity. The Generic Letter indicated that existing TS may not be sufficient to ensure that steam generator tube integrity can be maintained in accordance with current licensing and

design basis. The revised TS reflect a performance-based approach for ensuring tube integrity.

The staff finds that implementation of the Steam Generator Tube Integrity Program will continue to effectively identify degradation prior to failure and that there is appropriate guidance for re-evaluation, repair, or replacement for locations where degradation is found. As a point of clarification, Generic Letter 2006-01 did not "require that all PWRs implement the alternative Technical Specification (TS) requirements or submit a description of their program for ensuring tube integrity," but "requested that addressees either submit a description of their program for ensuring SG tube integrity for the interval between inspections or adopt alternative TS requirements for ensuring SG tube integrity."

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.8, provides the applicant's UFSAR Supplement for the Steam Generator Tube Integrity Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in SRP-LR, Table 3.1-2.

In LRA Section A.5, Commitment No. 8, the applicant committed to the continued implementation of the existing Steam Generator Tube Integrity Program during the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Steam Generator Tube Integrity Program in the UFSAR Supplement as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Steam Generator Tube Integrity Program, the staff finds all program elements consistent with the GALL Report. The staff also finds that the aging effects of SG tubes and tubes repairs will be adequately managed and that the AMP is acceptable for managing the aging effects of accessible SG secondary side internal components with the guidance of NEI 97-06. 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 the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.5 Selective Leaching of Materials

Summary of Technical Information in the Application. LRA Section B.2.1.19 describes the new Selective Leaching of Materials Program as being consistent with GALL AMP XI.M33, "Selective Leaching of Materials."

The applicant stated that the program will be implemented prior to the period of extended operation and will consist of one-time inspections to determine if loss of material due to selective leaching is occurring. The applicant also stated that the scope of the program will include susceptible materials including gray cast iron and copper alloy with greater than 15% zinc and located in potentially aggressive environments that include raw water, closed cooling water, treated water, and soil.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in GALL AMP XI.M33, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.M33.

LRA Section B.2.1.19 states that the program provides for visual inspections, hardness tests, and other appropriate examinations, to identify and confirm existence of the loss of material due to selective leaching. The applicant also stated that condition monitoring and expanded sampling will be utilized, as required, to ensure the components will perform as designed.
Based on its review, the staff finds the applicant's Selective Leaching of Materials Program consistent with the program elements of GALL AMP XI.M33, "Selective Leaching of Materials Program," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.19 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

LRA Section B.2.1.19 states that the Selective Leaching of Materials Program is a new program and there is no plant-specific program operating experience. However, the applicant also stated that the review of plant specific operating experience identified the dezincification of copper alloys containing greater than 15% zinc in treated water environments. Specifically, in December 2004, the applicant found dezincification occurred in a tubing cap of a test tee for a pressure gauge in the main steam system, and this condition contributed to the failure of the tubing cap. The applicant replaced the cap with stainless steel material, which is not susceptible to selective leaching. As part of the corrective action, the applicant replaced another cap on a companion gauge and conducted extent-of condition walkdowns in the immediate area of the failed cap, to determine if other components had similar dezincification degradation, and did not identify any discrepancies.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.19 provides the UFSAR Supplement for the Selective Leaching of Materials Program. The staff confirmed that the UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in SRP-LR Table 3.3-2.

In LRA Section A.5, Commitment No. 19, the applicant committed to implement the Selective Leaching Program prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Selective Leaching of Materials Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Selective Leaching of Materials Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this program and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.6 ASME Section XI, Subsection IWL

Summary of Technical Information in the Application. LRA Section B.2.1.25 describes the existing ASME Section XI, Subsection IWL program as being consistent with GALL AMP XI.S2 "ASME Section XI, Subsection IWL."

The applicant stated that the ASME Section XI, Subsection IWL program implements examination requirements of the ASME Boiler and Pressure Vessel (B&PV) Code, Section XI, Subsection IWL for reinforced and prestressed concrete containments (Class CC), 1992 Edition with the 1992 Addenda, as mandated in 10 CFR 50.55a, for managing loss of material (spalling, scaling) and cracking/freeze-thaw, cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel, cracking/expansion and reaction with aggregates, increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack for concrete; loss of material/general, pitting, and crevice corrosion for tendon wires and end anchorage components, and loss of prestress/relaxation; shrinkage; creep; elevated temperature of the tendons.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in GALL AMP XI.S2, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.S2.

Based on its review, the staff finds that the applicant's ASME Section XI, Subsection IWL program provides assurance that aging of reinforced and prestressed concrete containment structures will be adequately managed. The staff also finds the applicant's ASME Section XI, Subsection IWL Program consistent with the program elements of GALL AMP XI.S2, "ASME Section XI, Subsection IWL," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.25 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the operating experience of the ASME Section XI, Subsection IWL activities shows no adverse trend of program performance. LRA Section B.2.1.25 summarizes the 30th year (2005) surveillance results and corrective actions. The staff reviewed the summary of 25th year (2000) reactor building ISI inspection results and corrective actions, as well as some earlier results and corrective actions. The staff determined that the operating experience indicates that loss of material (spalling, scaling) and cracking/freeze-thaw, cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel, cracking/expansion and reaction with aggregates, increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack for concrete; loss of material/general, pitting, and crevice corrosion for tendon wires and end anchorage components, and loss of prestress/relaxation; shrinkage; creep; elevated temperature of the tendons; are being adequately managed.

The staff also determined that operating experience of the ASME Section XI, Subsection IWL Program did not show any adverse trend in performance. The applicant's evaluation indicated that problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. The staff determined that the applicant provided appropriate guidance for re-evaluation, repair, or replacement for locations where degradation is found. The staff noted that the applicant performs periodic self-assessments of the ASME Section XI, Subsection IWL program to identify the areas that need improvement to maintain the quality performance of the program.

Based on its review, the staff finds that the applicant's administrative controls are effective in detecting age-related degradation and initiating corrective action.

Based on its review, the staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A. 2.1.25 provides the UFSAR Supplement for the ASME Section XI, Subsection IWL Program. The staff confirmed that the UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 25, the applicant credited the existing program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the ASME Section XI, Subsection IWL Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI, Subsection IWL Program the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 program and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.7 10 CFR Part 50, Appendix J

Summary of Technical Information in the Application. LRA Section B.2.1.27 describes the existing 10 CFR Part 50, Appendix J Program as being consistent with GALL AMP XI.S4 "10 CFR 50, Appendix J."

The applicant stated that 10 CFR 50, Appendix J Program monitors leakage rates through the containment pressure boundary, including penetrations and access openings, and that containment leak rate tests assure that leakage through the primary containment and systems and components penetrating primary containment does not exceed acceptance criteria limits. The applicant stated that it uses Option B, the performance-based approach to implement the requirement of containment leak rate monitoring and testing.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in GALL AMP XI.S4, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.S4.

Based on its review, the staff finds that the applicant's 10 CFR Part 50, Appendix J Program provides assurance that leakage through the primary containment and system and components penetrating primary containment will be adequately managed. The staff also finds the applicant's 10 CFR Part 50, Appendix J Program consistent with the program elements of GALL AMP XI.S4, "10 CFR 50, Appendix J," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.27 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff identified one issue where additional information was requested from the applicant to complete its review. The issue concerns the measurement of leak rate tests. According to 10 CFR 50, Appendix J, La (%/24 hours), the maximum allowable leakage rate at pressure Pa as specified in the TS, should be used as a measurement for the leak rate test. The staff noted that recent containment local leak rate tests (LLRT) were performed in 2001, 2003, 2005, and 2007, however, the applicant presented these results in term of SCCM (Standard Cubic Centimeters per minute). In RAI B.2.1.27-1, dated October 7, 2008, the staff requested that the applicant provide additional information concerning the leak rated test results. The staff requested that the leak rate test results be provided in terms of La.

In its response to the RAI, dated October 30, 2008, the applicant presented the leak rate test results in terms of La, the maximum allowable leakage rate at pressure Pa as specified in the TS. For Type B and C tests, the allowable leakage rate is $0.6L_a$. The staff noted that the test results indicated a positive trend in performance on LLRT, except that individual valves on occasion exceed the leakage acceptance test values and repairs were made in accordance with the program. The staff also noted that the test results indicated that the ILRT results are well under the acceptance criteria.

Based on its review, the staff finds the applicant's response to RAI B.2.1.27-1 acceptable. The staff's concern described in RAI B.2.1.27-1 is resolved.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.27 provides the UFSAR Supplement for the 10 CFR Part 50, Appendix J Program. The staff confirmed that the UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 27, the applicant credited the existing program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the 10 CFR Part 50, Appendix J Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's 10 CFR Part 50, Appendix J Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 program and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.8 Protective Coating Monitoring and Maintenance Program

Summary of Technical Information in the Application. LRA Section B.2.1.29 describes the existing Protective Coating Monitoring and Maintenance Program as being consistent with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program."

The applicant stated that the program is not originally committed to RG 1.54 for Service Level 1 coatings because the plant was licensed prior to the issuance of this RG in 1973. The applicant also stated that it is committed to a modified version of this RG, as responses to GL 98-04. The applicant further stated that the program is a "comparable program" as described in GALL AMP XI.S8.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in GALL AMP XI.S8, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.S8.

Based on its review, the staff finds the applicant's Protective Coating Monitoring and Maintenance Program consistent with the program elements of GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.29 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

LRA Section B.2.1.29 states that demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that degradation of Service Level 1 protective coatings are being adequately managed. The applicant also stated that the Protective Coating Monitoring and Maintenance Program will be effective in assuring that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.
The staff determined that the applicant's Protective Coating Monitoring and Maintenance Program has been effective in detecting degraded coatings at various areas within the containment during refueling outages. The staff noted that some areas with minor degraded coatings in containments during refueling outages is typical of industry experience. The applicant stated that if areas with degraded coating were detected, they were entered into its corrective action program and the degraded coatings were then removed, repaired, or deferred repair while maintaining the total degraded area below the permitted amount subject to detachment from the substrate during a loss of coolant accident (LOCA) to ensure post-accident operability of the emergency core cooling system (ECCS) suction strainers.

The staff finds that the applicant's Protective Coating Monitoring and Maintenance Program has been effective in identifying, monitoring, and correcting the effects of protective coating degradation and revealed no degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.29 provides the UFSAR Supplement for the Protective Coating Monitoring and Maintenance Program. The staff confirmed that the UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 29, the applicant credited the existing program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the Protective Coating Monitoring and Maintenance Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Protective Coating Monitoring and Maintenance Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B.2.1.30 describes the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as being consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR50.49 Environmental Qualification Requirements."

The applicant stated that this program will be used to manage non-EQ cables and connections within the scope of license renewal that are subject to adverse localized environments. The applicant also stated that a sample of accessible electrical cables and connections installed in adverse environments will be visually inspected for signs of accelerated age-related degradation such as embrittlement, discoloration, cracking, or surface contamination.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in GALL AMP XI.E1, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.E1, but also identified an issue for which the staff requested additional information.

GALL AMP XI.E1 states that an adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable. In RAI B.2.1.30-1, dated October 07, 2008, the staff requested that the applicant provide additional information to explain in detail how adverse localized environment is defined based on the most limiting designed service environment of cables (radiation, temperature, and moisture) within the scope of GALL AMP XI.E1.

In its response to the RAI dated October 30, 2008, the applicant stated that general plant area ambient temperatures range from 70^{o} F to 140^{o} F, and general plant area radiation doses range from 0 Rads to 6.57E06 Rads. The applicant also stated that the 60-year insulation design limits are used in conjunction with plant specific environmental design limits and plant operating experience to select general plant areas and localized areas in which to perform the visual inspections of a representative sample of cable and connection insulation. The applicant stated that a specific limiting temperature or radiation dose is not used as exclusion criteria to eliminate plant areas from consideration for walk down and subsequent cable and connection insulation inspections. The applicant also provided a draft procedure titled, "Inspection of non EQ cables and connections for managing adverse localized environments." In the draft procedure, the applicant provided ambient conditions for areas within the scope of license renewal. In its draft procedure, the applicant also stated that if information exists that identifies an area as "adverse," from a previous walk-down or plant operating experience (PIFs, corrective action reports), that this area is recorded as a potential adverse environment. The staff reviewed the procedure and found its approach to identifying adverse localized environment inadequate because the applicant's response did not demonstrate how plant specific cable specifications satisfies the GALL Report's definition of adverse localized environment, which states that an adverse localized environment is one which is significantly more severe than the specified service environment for the cable.

In its supplemental response to the RAI dated January 30, 2009, the applicant stated that the thresholds for identifying adverse localized environments have been set at 112^{o} F and 5E04 Rads corresponding to TMI-1's limiting cable insulation materials, polyvinyl chloride (PVC) and teflon insulations, respectively. The applicant further stated that the cable and connection insulations' 60-year design limits are taken from the EPRI Report 1013475, "Plant Support Engineering: License Renewal Electrical Handbook," dated February 2007, and that those limits will be incorporated into the implementing procedure for this AMP.

Based on its review, the staff finds the applicant's responses to RAI B.2.1.30-1 acceptable because the applicant provided a numerical value of the most limiting designed service environment of cables (radiation and temperature) within the scope of GALL AMP XI.E1 which satisfies the GALL Report's definition of adverse localized environment, which states that an adverse localized environment is one which is significantly more severe than the specified service environment for the cable. The staff's concern described in RAI B.2.1.30-1 is resolved.

Based on its review, the staff finds the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program consistent with the program elements of GALL AMP XI.E1.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.30 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that in response to the cable insulation degradation experienced in an adverse localized environment at Turkey Point, it has evaluated plant configurations for the potential of heat damage to cable insulations. The applicant determined that the subject design configuration does not exist. Additionally, the applicant stated that it has identified several instances of potential age-related degradation of cables during the conduct of routine maintenance activities and dispositioned them using the corrective action process. The applicant further stated that in each case, engineering evaluations determined the cause of the apparent degradation, the effect on operability, and appropriate corrective actions, providing plant specific operating experience that provides objective evidence demonstrating effectiveness of the corrective action program in identifying and resolving potential aging related cable and connection insulation degradation issues. The staff verified that the applicant had appropriately identified the root causes of cable aging and took appropriate corrective actions. The staff reviewed the issue reports on these events that were provided by the applicant.

Therefore, the staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.30 provides the applicant's UFSAR Supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in SRP-LR.

In LRA Section A.5, commitment No. 30, the applicant committed to implement this program prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff finds that those program elements for which the applicant claimed consistency with the

GALL Report are consistent. The staff also reviewed the applicant's responses to the RAI and finds them acceptable. The staff concludes that the applicant has demonstrated that effects of 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 the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.10 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B.2.1.32 describes the new Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as being consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements ."

The applicant stated that the program manages inaccessible medium voltage cables that are exposed to significant moisture simultaneously with significant voltage. The applicant also stated that inaccessible medium voltage cables subject to significant moisture and voltage will be tested as part of this program and that manholes associated with the in scope, non-EQ, inaccessible cables subject to significant moisture and voltage will be inspected, so that draining or other corrective actions can be taken. The applicant also stated that Inspections for water collection will be performed at a frequency of twice per year, in accordance with existing practices.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the program elements in the applicant's program to those in GALL AMP XI.E3, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP XI.E3.

Based on its review, the staff finds the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program consistent with the program elements of GALL AMP XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.32 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff reviewed operating experience and noted that inaccessible medium-voltage cables in certain manholes at Three Mile Island have experienced significant moisture (cable in standing water for more than few days). In addition, during a walk down, the staff found cables submerged under water in Manholes 7A and 7B which had already been inspected two weeks prior. The staff observed rusting on cable support structures and marking on the walls of these pairs of manholes which revealed evidence of a chronic water problem. The staff finds that this incident demonstrates that the corrective actions previously described by the applicant have not been properly implemented or were not adequate. The inspection and water removal frequency of twice per year, as proposed by the applicant's Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, may not be adequate to detect water accumulation in the manholes. In RAI B.2.1.32-1, dated October 07, 2008, the staff requested that the applicant provide additional information concerning the certification from the manufacturer on the submergence capability of the cables, or identify specific actions that will be taken to preclude the degradation of cables.

In its response to the RAI dated October 30, 2008, the applicant stated that the frequency of the inspections will be adjusted based on inspection results and that this change in inspection frequency recognizes that the objective of the inspections, as a preventive action, is to keep the cables infrequently submerged, thereby minimizing their exposure to significant moisture. The applicant also stated that this change in inspection frequency also recognizes that a recurring inspection, set at the correct frequency, would result in the cables being submerged only as a result of event driven, rain and drain type occurrences. The staff determines that the applicant provided an adequate explanation because the identified actions are bounded by GALL AMP XI.E3. The staff's concern described in RAI B.2.1.32-1 is resolved.

The staff has identified water in manholes as a generic, current operating plant issue in Information Notice 2002-12, "Submerged Safety-Related Electrical Cables," dated March 21, 2002, and Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems Or Cause Plant Transients," dated February 7, 2007. The staff will address water in manholes, during the current period of operation, through the reactor oversight process in accordance with the requirements of 10 CFR Part 50.

The staff determined that the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program if implemented as described, would ensure that the aging affects on inaccessible medium-voltage cables, due to exposure to significant moisture and significant voltage, will be adequately managed during the period of extended operation, in accordance with the guidance contained in AMP XI.E3 of the GALL Report. The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new aging management program which will require the applicant to test the cables and to evaluate plant-specific operating experience to determine if the inspection frequency of the manholes should be increased to ensure that the cables will be maintained in a dry environment during the period of extended period of operation.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and is SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

<u>UFSAR Supplement</u>. LRA Section A.2.1.32, provides the applicant's UFSAR Supplement for the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 32, the applicant committed to implement the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program and the applicant's responses to the RAI, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of 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 Environmental Qualification (EQ) of Electrical Components

Summary of Technical Information in the Application. LRA, Section B.3.1.3, describes the existing Environmental Qualification (EQ) of Electric Components Program as being consistent with GALL AMP X.E1, "Electrical Qualification (EQ) of Electrical Components."

The applicant stated that this program complies with 10 CFR 50.49, EQ of Electrical Equipment Important to Safety for Nuclear Power Plants and that all EQ equipment is included within the scope of license renewal. The applicant also stated that the program provides for maintenance of the qualified life for electrical equipment important to safety within the scope of 10 CFR 50.49. The applicant further stated that qualified life is determined for equipment within the scope of EQ program and appropriate actions such as reanalysis, replacement, or refurbishment are taken prior to or at the end of the qualified life of the equipment so that the aging limit is not exceeded.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

The staff reviewed on-site bases documents related to the EQ of Electrical Components Program and also reviewed plant implementing procedures, preventive maintenance work orders, and EQ program engineering change requests.

In comparing the program elements in the applicant's program to those in GALL AMP X.E1, the staff determined that the applicant's program elements are consistent with the recommendations of GALL AMP X.E1.

Based on its review, the staff finds the applicant's EQ of Electric Components Program consistent with the program elements of GALL AMP X.E1, "EQ of Electrical Components."

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.3.1.3 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that on September 15, 2006, it observed elevated building area temperatures due to an increase in outside ambient temperatures and equipment failures. The applicant also stated that proper evaluation of these conditions through the corrective action program demonstrated that the EQ of Electric Components Program was ensuring that EQ profiles were being met and immediate actions were taken to ensure that the elevated building area temperatures had not caused any components to exceed their qualified life. The applicant further stated that during the performance of maintenance activities, it identified and corrected conditions potentially adverse to maintaining the EQ qualification of components. On January 6, 2004, it identified a degraded EQ motor splice through the corrective action system. The applicant stated that it promptly evaluated the degraded splice for operability to ensure it met the requirements of the EQ file. The staff noted that during procurement activities, the applicant must demonstrate EQ qualification of components prior to installation. The applicant stated that on May, 18, 2004, a vendor supplied a component which had not had adequate EQ documentation. The applicant stated it delayed the installation of the component until the proper EQ paperwork was obtained.

In reviewing operating experience in Assignment Report (AR) 00465770 in plant basis document, TM-PBD-AMP-B.3.1.3, the staff noted that the feed water valve FW-V-16B/17B cabling was subject to 153.8^{o} F (68^{o} C) in the intermediate building. The EQ file ES-010T temperature for this zone is 110^{o} F. The applicant concluded that there was not immediate danger of end of life. In RAI B.3.1.3-1, dated October 7, 2008, the staff requested that the applicant provide additional information explaining why there was no immediate danger of end of life of this cable and how this increased temperature affected the EQ of this cable.

In its response to the RAI dated October 30, 2008, the applicant stated that it reviewed the EQ binder for the cables associated with the Feed Water valves FW-V-16B and FW-17B and found that the cables are normally de-energized 125 Vdc control cables and are conservatively qualified to 90^{o} C/198^{o} F for a 40-year plant life. The applicant concluded that the cables are qualified, with margin, for temperature in excess of the normal ambient conditions (110^{o} F) and with margin, for temperature in excess of the temporary excursion of 153.8^{o} F resulting from the short-term unavailability of a ventilation fan. The applicant further stated that the cables were not exposed to temperature conditions that exceeded their qualification. Additionally, the cables are generally qualified with margin allowing for some fluctuation in environmental conditions without having impact to the cable qualification. The applicant also stated that based on the margin available in the qualification temperature, there was not immediate danger to the end of life for these cables, and there was no impact to the EQ or the qualified life of these cables.

Based on its review, the staff finds that applicant’s response to RAI B.3.1.3-1 acceptable because the cables are qualified to the environment of 198^{o} for a 40-year life and that the temporary increased temperature environment of 153.8^{o} F resulting from the short-term unavailability of a ventilation fan did not affect the EQ of these cables. The staff’s concern discussed in RAI B.3.1.3-1 is resolved.

The staff finds that the operating experience identified above and those identified in program basis documents demonstrate that identification of program weakness and timely corrective actions as part of the EQ program provide assurance that program will remain effective in assuring that equipment is maintained within its qualification basis and qualified life.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.3.1.3, provides the applicant's UFSAR Supplement for the EQ of Electric Components Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 39, the applicant credited the existing program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the EQ of Electric Components Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's EQ of Electrical Component Program and the applicant's response to the RAI, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 That Are Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant identified the following AMPs that were, or will be, consistent with the GALL Report, with exceptions or enhancements:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- Water Chemistry
- Reactor Head Closure Studs
- Flow-Accelerated Corrosion
- Open-Cycle Cooling Water System
- Closed-Cycle Cooling Water System
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Compressed Air Monitoring
- Fire Protection
- Fire Water System
- Aboveground Steel Tanks
- Fuel Oil Chemistry
- Reactor Vessel Surveillance

- One-Time Inspection
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWF
- Structures Monitoring Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
- Metal Enclosed Bus
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Metal Fatigue of Reactor Coolant Pressure Boundary
- Concrete Containment Tendon Prestress

For AMPs that the applicant claimed are consistent with the GALL Report, with exceptions or enhancements, the staff performed an audit to confirm that those attributes or features of the program for which the applicant claimed consistency with the GALL Report were indeed consistent. The staff also reviewed the exceptions and enhancements to the GALL Report to determine whether they were acceptable and adequate. The results of the staff's audit and reviews are documented in the following sections.

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

Summary of Technical Information in the Application. LRA Section B.2.1.1, describes the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program as being consistent, with exceptions, to GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

The applicant stated that this program provides inspections which are performed to manage cracking and loss of fracture toughness in Class 1, 2, and 3 piping and components within the scope of license renewal. The applicant also stated that this program provides for the periodic visual, surface, and volumetric examination and leakage testing of pressure-retaining piping and components including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions to determine whether the program is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M1, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with two exceptions.

Exception 1. The LRA states the following exception to the GALL Report:

> NUREG-1801 specifies the 2001 ASME Section XI B&PV Code, including the 2002 and 2003 Addenda for Subsections IWB, IWC, and IWD. The TMI-1 ISI Program Plan for the third ten-year inspection interval effective from April 20, 2001 through April 19, 2011, approved per 10 CFR 50.55a, is based on the 1995 ASME Section XI B&PV Code, including 1996 addenda. The next 120-month inspection interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval.

During the audit and review the staff noted that the ASME Section XI B&PV Code editions and addenda referenced by the applicant are different than the editions described in the GALL Report for the third ISI period. The third ISI period is within the current licensing period and therefore, the staff determined that the GALL Report guidance does not apply. The staff approved the current ISI program under the 10 CFR 50.55a process. In the LRA, the applicant stated, "The next 120-month inspection interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval," and therefore, the staff determined that the applicant's program will be in accordance with the GALL Report during the period of extended operation. The staff determined that there is no exception to the GALL Report AMP XI.M1. In RAI B.2.1.1-1, dated September 29, 2008, the staff requested the applicant provide additional information explaining this exception to GALL AMP XI.M1.

In its response dated October 20, 2008, the applicant stated that the exception should be deleted from the LRA because the staff has approved the current ISI program under the 10 CFR 50.55a process.

Based on its review, the staff finds the applicant's response to RAI B.2.1.1-1 acceptable because the applicant's ISI program will be in accordance with the recommendations of GALL AMP XI.M1 during the period of extended operation. The staff's concern described in RAI B.2.1.1-1 is resolved.

Exception 2. The LRA states the following exception to the GALL Report:

> NUREG-1801 specifies the use of ASME Section XI B&PV Code, which includes requirements for examining Class 1 Category B-F and B-J, and Class 2 C-F-1 and C-F-2 piping components. At TMI-1, an alternate method approved in accordance with 10 CFR 50.55a is used to determine the inspection frequency for Class 1 Category B-F and B-J, and Class 2 Category C-F-1 and C-F-2 welds in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety. This method also addresses volumetric examination of welds less than NPS 4 inches. Other portions of the ASME Section XI ISI program outside of this scope remain unaffected.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and, "acceptance criteria" program elements.

The staff noted that the applicant uses risk informed inservice inspection (RI-ISI) to determine inspection frequency and noted that RI-ISI and the use of specific Code Cases have been approved by the staff under the 10 CFR 50.55a process for the current ISI program and only apply to the Third ISI interval and are not applicable during the period of extended operation. The staff noted the fourth ISI interval will be performed during the period of extended operation and that the applicant's program will be submitted to the staff for the fourth ISI interval during the current license period. In RAI B.2.1.1-2 dated September 29, 2008 the staff requested the applicant provide additional information on whether they will follow ASME Code requirements and approved code cases in RG 1.147.

In its response dated October 20, 2008, the applicant stated that NRC approved ASME Code inspection requirements will be followed during the fourth ISI interval which will begin April 20, 2011 and continue during the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.2.1.1-2 acceptable and also finds the exception to the GALL Report acceptable because (1) the applicant's ISI program will be in accordance with ASME Code inspection requirements endorsed by the staff in 10 CFR 55a, (2) the applicant's ISI program will be in accordance with the recommendations provided in GALL AMP XI.M1 during the period of extended operation, and (3) the intent of the GALL report is for applicants to use the version of the ASME code in effect 12 months prior to commencement of the period of extended operation. The staff's concern described in RAI B.2.1.1-2 is resolved.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.1 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the effects of aging are effectively managed through objective evidence showing that cracking due to stress corrosion cracking, cracking due to thermal and mechanical loading, cracking due to cyclic loading, and loss of fracture toughness due to thermal aging embrittlement are being adequately managed. The applicant stated that the examples of the operating experience in the LRA provide objective evidence that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed operating experience reports and Assignment Reports. The staff noted that there is a history of degradation of the containment liner that was discovered during ISI. The staff noted that repair of the containment liner would be completed in accordance with the applicant's corrective action program prior to entering the period of extended operation.

An inspection performed by the applicant of a pressurizer surge line nozzle safe-end end weld revealed a crack in the alloy 82/182 weld metal. The applicant's corrective action process provided for repair of the surge line safe-end-to-nozzle weld, and provided for augmented inspections of the surge line safe-end-to-nozzle welds during future refueling outages, and the expansion of inspection scope for similar welds. The applicant's nuclear oversight assessments have identified deficiencies in elements of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program that were subsequently corrected through the applicant's corrective action program including inspection procedures that were not updated to the current applicable

ASME Code and deficiencies in documentation of repair work and inspection activities. The staff determined that these examples of operating experience provided evidence of the effectiveness of the applicant's program.

The staff noted that the documentation provided by the applicant during the onsite review supported the applicant's statements regarding operating experience and the staff also confirmed that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement Review. LRA Section A.2.1.1 provides the applicant's UFSAR Supplement for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in SRP-LR, Table 3.1-2.

In LRA Section A.5, Commitment No. 1, the applicant committed to the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program during the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and the applicant's responses to the RAIs, the staff finds 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 finds that the program, with exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this program and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.2.2 Water Chemistry

Summary of Technical Information in the Application. LRA Section B.2.1.2 describes the existing Water Chemistry Program as being consistent, with an enhancement, to GALL AMP XI.M2, "Water Chemistry Program."

The applicant stated that the program provides monitoring and control of the chemical environments in the primary cycle and secondary cycle systems so that aging effects of system components are minimized. The applicant stated that the primary cycle scope of the program consists of the reactor coolant system and related auxiliary systems containing reactor coolant (borated treated water), including the primary side of the steam generators; and that the secondary cycle scope of the program consists of various secondary side systems and the secondary side of the steam generators. The applicant also stated that the program is consistent with Electric Power Research Institute's (EPRI), "Pressurized Water Reactor (PWR) Primary Chemistry Guidelines," Revision 5, and with plant technical specification limits for fluorides, chlorides, and dissolved oxygen. The applicant also stated that the program will be enhanced to become consistent with EPRI, "PWR Secondary Water Chemistry Guidelines," Revision 6, and that the enhancement will incorporate continuous monitoring of sodium in steam generator blowdown.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in the GALL Report AMP XI.M2, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff did, although, identify issues with the chemistry parameter action limits and diagnostic parameter sampling frequency. In RAI B.2.1.2-1, dated September 29, 2008, the staff requested that the applicant provide additional information concerning this issue.

In RAI B.2.1.2-1, the staff noted following differences between the plant's implementing procedures for its Water Chemistry Program and recommendations in EPRI's PWR Primary Coolant Chemistry Guidelines, Revision 5:

(a) There is no dissolved oxygen action limit for AL2 recommended by EPRI, but plant procedure uses a value of greater than 100 parts per billion (ppb).

(b) The dissolved oxygen action limit for AL3 recommended by EPRI is greater than 100 ppb, but plant procedure uses a value of greater than 1000 ppb.

(c) The sampling frequency for conductivity recommended by EPRI is once per day, but plant procedure uses a value of five per week.

(d) The sampling frequency for pH recommended by EPRI is once per day, but plant procedure uses a value of five per week.

(e) The sampling frequency for boron recommended by EPRI is once per day, but plant procedure uses a value of two per week.

The staff requested that the applicant explain why these differences are not considered to be exceptions to GALL AMP XI.M2, which states that a PWR applicant's primary water chemistry program should be based on EPRI's PWR Primary Water Chemistry Guidelines, Revision 3 or later. The staff also asked the applicant to provide a technical justification as to why the differences between the applicant's program and the recommendations in the EPRI guidelines are acceptable to provide adequate protection for components affected by primary water chemistry.

In its response to the RAI dated October 20, 2008, the applicant stated that Revision 6 of EPRI's PWR Primary Water Chemistry Guidelines, dated December 2007, has been implemented and that there was a change in the dissolved oxygen concentration action limits between Revisions 5 and 6 of the EPRI guideline. The applicant stated that the dissolved oxygen concentration action limits in Revision 6 of the guidelines are identical to the action limits in the TMI-1 chemistry procedures. The applicant also stated that Revision 6 of the ERPI guidelines no longer require sampling for pH. The applicant also stated that the EPRI guidelines allow measurement of conductivity and boron concentration to be based on individual plant needs because they are diagnostic parameters, rather than control parameters, and that conductivity measurements and boron concentration measurements of five times per week and two times per week, respectively, are adequate based on TMI-1's TS and operating experience.

The staff reviewed the applicant's response to RAI B.2.1.2-1 together with EPRI's PWR Primary Water Chemistry Guidelines, Revision 6, dated December 2007 and noted that the applicant's procedural limits on dissolved oxygen content in reactor coolant are consistent with the recommendations of EPRI's PWR Primary Water Chemistry Guidelines, Revision 6. The staff also noted that the applicant implemented the change to use EPRI's PWR Primary Water Chemistry Guidelines, Revision 6, after the LRA submittal date of January 08, 2008. The staff noted that the change in recommended action limits between Revision 5 and Revision 6 of the EPRI guidelines provides an additional 24 hour window for plant operations to restore dissolved oxygen content to acceptable levels if dissolved oxygen concentration is greater than 100 ppb, but less than 1000 ppb. The staff finds the additional 24 hour operating window to be acceptable because it provides additional flexibility to implement corrective actions without allowing an elevated dissolved oxygen concentration to continue for a substantially longer time than was allowed under the previous EPRI guidelines. The staff finds the applicant's response with regard to dissolved oxygen concentration to be acceptable because it is consistent with the most recent EPRI PWR Primary Water Chemistry Guidelines and is consistent with the recommendation in the GALL Report that a PWR primary water chemistry program be based on Revision 3 or later editions of EPRI PWR Water Chemistry Guidelines.

The staff reviewed the applicant's response with regard to sampling frequency for the diagnostic parameters, primary water conductivity, pH, and boron concentration. The staff noted that Revision 6 of the EPRI guidelines has deleted the previous recommendation for sampling of pH. The staff also noted that the EPRI guidelines describe diagnostic parameters as assisting interpretation of primary coolant chemistry variations, rather than requiring strict control due to material integrity issues, and the guidelines classify diagnostic parameter measurement frequencies as suggestions that can be modified based on plant-specific operating experience and technical specification requirements. Based on changes in the EPRI guidelines that deleted recommendations for pH sampling and provisions that allow deviations from suggested sampling frequencies for diagnostic parameters, the staff determined that the applicant's procedural requirements related to sampling frequencies for pH, conductivity, and boron concentration are consistent with EPRI's most recent PWR Primary Water Chemistry Guidelines and are, therefore, consistent with recommendations in the GALL Report. On this basis, the staff finds the applicant's response with regard to diagnostic parameters to be acceptable.
The staffs concerns described in RAI B.2.1.2-1 are resolved.

Enhancement. LRA Section B.2.1.2 states the following enhancement to the GALL Report:

> The TMI-1 Water Chemistry Program will be enhanced to include the continuous monitoring of steam generator blowdown for sodium during startup and hot standby conditions as required by EPRI 1008224, "PWR Secondary Water Chemistry Guidelines," Revision 6. This enhancement will be implemented after replacement of the existing once-through steam generators and prior to the period of extended operation for TMI-1.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program," and, "monitoring and trending" program elements.

In the applicant's program basis document for the Water Chemistry Program, the applicant stated that the EPRI guidance is not currently being followed because of existing plant design and hydraulic conditions which prevent the collection of steam generator blowdown samples while simultaneously operating steam generator blowdown. The applicant stated that in lieu of continuously monitoring steam generator blowdown for sodium, steam generator feedwater is continuously monitored, and steam generator grab samples are collected and analyzed for sodium on a minimum frequency of once per four hours. The applicant stated that these practices will continue until the once-through steam generators are replaced. The applicant stated that the replacement steam generators will support simultaneous sodium monitoring and blowdown as recommended in EPRI's PWR Secondary Water Chemistry Guidelines, Revision 6.

In LRA Section A.5, Commitment 2, the applicant committed to enhance the Water Chemistry Program to incorporate continuous monitoring of sodium in steam generator blowdown prior to the period of extended operation.

Based on its review, the staff finds the enhancement acceptable because it will bring the applicant's Water Chemistry Program into conformance with EPRI's PWR Secondary Water Chemistry Guidelines that are the basis for the GALL Report's Water Chemistry Program and the because applicant committed to implement the enhancement prior to the period of extended operation.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.2 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the Water Chemistry Program is a preventative program that assures contaminants are maintained below applicable limits to prevent the aging of plant piping and components and that potential aging effects of cracking, denting, loss of material, reduction of heat transfer, and reduction of neutron-absorbing capacity are being adequately managed. The applicant provided three examples of site-specific operating experience to demonstrate effectiveness of the program as follows:

(1) The applicant stated that in June 2002, feedwater sodium level exceeding Action Level 1 values of 1 ppb were identified. The applicant stated this was the only occurrence of a chemistry action level being exceeded in the preceding five years. The applicant stated that an investigation identified the cause of the sodium increase as a condenser tube leak, and prompt corrective actions led to restoring the feedwater sodium value to below 1 ppb within one day of discovery.

(2) The applicant stated that in March 2004, a focused area self-assessment of the Water Chemistry Program was performed. The applicant stated that the self-assessment confirmed strengths and identified deficiencies in the program, and that programmatic deficiencies were evaluated and corrective actions taken, including procedure revisions to incorporate needed changes.

(3) The applicant stated that in May 2006, routine water chemistry monitoring identified chloride concentration in the reactor coolant system that was higher than administrative

goals. The applicant further stated that the cause of the higher-than-goal chloride levels was identified, and corrective actions were identified and implemented to reduce chloride levels to below the administrative goals.

In addition to these examples, the staff reviewed the applicant's operating experience discussion provided in the applicant's program basis document binder for the Water Chemistry Program. The staff reviewed additional selected corrective ARs related to the Water Chemistry Program and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

Based on this review, the staff finds (1) that the operating experience for this program demonstrates that the applicant's Water Chemistry Program is achieving its objective of mitigating aging effects of cracking, denting, loss of material, reductions of heat transfer and reduction of neutron-absorbing capacity for materials exposed to primary cycle and secondary cycle treated water; and (2) that the applicant is taking appropriate corrective actions through implementation of this program.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement Review. In LRA Section A.2.1.2, the applicant provided the UFSAR Supplement for the Water Chemistry Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance for this type of program as found in SRP-LR Table 3.1-2.

In LRA Section A.5, Commitment No. 2, the applicant committed to ongoing implementation of the Water Chemistry Program for aging management of applicable components during the period of extended operation and also committed to the program enhancement regarding continuous monitoring of sodium in steam generator blowdown prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Water Chemistry Program in the UFSAR Supplement as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Water Chemistry program and the applicant's response to the staff's RAI, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the enhancement and confirms that its implementation through Commitment No. 2 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.2.3 Reactor Head Closure Studs

Summary of Technical Information in the Application. LRA Section B.2.1.3 describes the existing Reactor Head Closure Studs Program as being consistent, with exceptions, to GALL AMP XI.M3, "Reactor Head Closure Studs."

The applicant stated that the program manages the effects of aging for reactor head closure studs and stud components constructed from materials with a maximum tensile strength limited to less than 170 ksi through the implementation of plant procedures following the examination and inspection requirements of ASME Section XI Table, IWB-2500-1, and the guidance provided in NRC RG 1.65, "Materials and Inspection for Reactor Vessel Closure Studs." The applicant further stated that aging effects requiring management include cracking due to stress corrosion cracking, and loss of material due to wear, general, pitting and crevice corrosion.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions to determine whether the AMP, with the exceptions is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP XI.M3, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, but several issues were identified with the "scope of program," "detection of aging effects," and "preventive actions" program elements.

The staff determined that a possible exception to the "scope of program" and "detection of aging effects" program elements exists regarding the applicant's detection of coolant leakage. The staff determined that the applicant did not explicitly identify the detection of coolant leakage from reactor vessel closure stud bolting in its on-site basis documents. In RAI B.2.1.3-1, dated October 7, 2008, the staff requested that the applicant provide additional information on the applicant's leak detection process.

In its response to the RAI dated October 30, 2008, the applicant stated that the AMP will include techniques to detect coolant leakage from reactor vessel closure stud bolting. The applicant further clarified the issue and stated that the following statement should have been included in its basis document for sections 3.1.a "scope of the program," 3.4.a "detection of aging effects," and 3.5 "monitoring and trending,": During system pressure tests, VT-2 visual techniques are employed to monitor for coolant leakage.

Based on its review, the staff finds that this clarification meets the recommendations of GALL AMP XI.M3, and is acceptable. The staff's concern in RAI B.2.1.3-1 is resolved.

The staff determined that a possible exception to the "preventive actions" program element exists regarding the application of a stable lubricant. The staff determined that the applicant's on-site basis document identifies Dow Corning G-N metal spray as a lubricant used during the installation process for reactor head closure studs. Upon closer review of the specification sheet for this lubricant, the staff discovered that Dow Corning G-N metal spray is composed of 14% Molybdenum Disulfide. NRC RG 1.65 specifies the use of lubricants which are stable and compatible with the bolting and vessel materials and the surrounding environment. Molybdenum Disulfide is evaluated in EPRI-NP-5769, and NUREG/CR-3766, and found to be a compound that is discouraged from use because of its susceptibility to promote stress corrosion cracking. In RAI B.2.1.3-3, dated October 7, 2008, the staff requested that the applicant provide additional information concerning the use of this lubricant.

In its response to the RAI dated October 30, 2008, the applicant stated that current plant procedures specify the use of Dow Corning G-N Metal spray as a lubricant for the reactor head closure studs. The applicant further stated that the program will be enhanced to satisfy the recommendations of GALL AMP XI.M3. The applicant stated that the enhancement applies to the "scope of program" and "preventive actions" program elements as follows:

The Reactor Head Closure Studs program will be enhanced to select an alternate stable lubricant that is compatible with the fastener material and the environment. This enhancement will be implemented prior to the period of extended operation.

The staff reviewed the applicant’s enhancement and confirmed that no indication of deficiencies with reactor head closure studs or stud components was found in the past inspection results. The staff also reviewed EPRI-5769, Volume 1, Section 11 and found that it specifically identifies lubricants containing molybdenum disulfides as a common factor in several SCC related failures. The applicant’s enhancement directly addresses this issue, as it commits to include a specific precaution against the use of compounds containing sulfur (sulfide), including molybdenum disulfide (MoS_2), as a lubricant for bolting.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.3-2 acceptable because the AMP, with the enhancement, will be consistent with the recommendations of GALL AMP XI.M3. The staff’s concern in RAI B.2.1.3-2 is resolved.

Exception 1. The LRA states an exception to the GALL Report as follows:

> NUREG-1801, XI.M3, specifies the 2001 ASME Section XI B&PV Code, including the 2002 and 2003 Addenda. The current TMI-1 ISI Program Plan for the third ten-year inspection interval effective from April 20, 2001 through April 19, 2011, approved per 10 CFR 50.55a, is based on the 1995 ASME Section XI B&PV Code, including 1996 addenda. The next 120-month inspection interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval.

The staff reviewed the 1995 edition of the ASME Code Section XI including 1996 addenda, and found that this was the ASME Code Section XI edition in effect for the 3rd 10-Year ISI Interval for TMI Unit 1. The staff noted that the applicant is scheduled to enter its 4th 10-Year ISI Interval on April 20, 2011. Since the 1995 edition of the ASME Code Section XI including 1996 addenda was previously approved per 10 CFR 50.55a, the staff finds that the exception noted by the applicant is incorrectly designated as such. In RAI B.2.1.3-2, dated October 7, 2008, the staff requested that the applicant provide additional information clarifying whether this issue is an exception.

In its response to the RAI dated October 30, 2008, the applicant provided its agreement with the staff’s position. The applicant stated that a formal exception to the ASME code version listed in the GALL AMP XI.M3 is not necessary, and subsequently removed the exception from the LRA. The staff determined that the use of the 1998 Edition of the ASME Code Section XI, inclusive of the 2000 Addenda, is consistent with the program description statement in GALL AMP XI.M3 because the Statement of Consideration (SOC) of 10 CFR Part 54 clarifies that acceptable editions of the ASME Code Section XI are those acceptable endorsed editions up to the most recently endorsed edition discussed in 10 CFR 50.55a. The staff confirmed that the SOC of 10 CFR Part 54 does include this clarification, and that based on this clarification, use of the 1998 Edition of the ASME Code Section XI, inclusive of the 2000 Addenda, is consistent with the program description of GALL AMP XI.M3.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.3-2 acceptable because crediting the 1998 edition of the ASME Code Section XI, inclusive of the 2000 Addenda, is consistent with GALL AMP XI.M3. The staff’s concern in RAI B.2.1.3-2 is resolved.

Exception 2. The LRA states an exception to the GALL Report as follows:

> NUREG-1801, X1.M3, specifies that surface examination uses magnetic particle, liquid penetration, or eddy current examinations to indicate the presence of surface discontinuities and flaws in the reactor head closure studs. The current TMI-1 ISI program for the third interval does not require surface examination. The next 120-month inspection interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval.

The staff reviewed the 1995 edition of the ASME, Section XI, B&PV Code, including the 1996 addenda and found that the requirements of this edition have been met. The applicant stated that the next 10-year inspection interval will incorporate the code requirements specified in 10 CFR 50.55a twelve months before the start of the inspection interval. The staff noted that this examination requirement was not required as part of the 1995 edition of the code. The staff also noted that since the 1995 edition of the code including the 1996 addenda was previously approved per 10 CFR 50.55a, that the exception noted by the applicant is incorrectly designated as such. In RAI B.2.1.3-2 dated October 7, 2008, the staff requested that the applicant provide additional information clarifying whether this issue is an exception.

In its response to the RAI dated October 30, 2008, the applicant provided its agreement with the staff's position. The applicant stated that a formal exception to the ASME code version listed in the GALL AMP XI.M3 is not necessary, and subsequently removed the exception from the LRA. The staff determined that the use of the 1998 Edition of the ASME Code Section XI, inclusive of the 2000 Addenda, is consistent with the program description statement in GALL AMP XI.M3 because the SOC of 10 CFR Part 54 clarifies that acceptable editions of the ASME Code Section XI are those acceptable endorsed editions up to the most recently endorsed edition discussed in 10 CFR 50.55a. The staff confirmed that the SOC of 10 CFR Part 54 does include this clarification, and that based on this clarification, use of the 1998 Edition of the ASME Code Section XI, inclusive of the 2000 Addenda, is consistent with the program description of GALL AMP XI.M3.

Based on its review, the staff finds the applicant's response to RAI B.2.1.3-2 acceptable because crediting the 1998 edition of the ASME Code Section XI, inclusive of the 2000 Addenda, is consistent with GALL AMP XI.M3. The staff's concern in RAI B.2.1.3-2 is resolved.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.3 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the program is being effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews. The staff reviewed the operating experience reports to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The reports indicated that during recent refueling outages in 2003 and 2005, UT, MT, and VT-1 exams were conducted which found no undesirable indications. The applicant further stated that no undesirable indications have ever been recorded on the reactor head closure studs, but that industry operating experience is utilized to supplement its own AMP by completing industry recommendations and evaluations to address issues that have occurred at other plants. Additionally, the staff reviewed several industry operating experiences along with the resulting response taken by the applicant to apply the lessons learned to its own program and found the responses to be satisfactory.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA section A.2.1.3 provides the applicant's UFSAR Supplement for the Reactor Head Closure Studs Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 3, the applicant committed to credit the program for aging management during the period of extended operation. In its letter dated October 30, 2008, the applicant revised Commitment No. 3 to incorporate the enhancement concerning the selection of an alternate stable lubricant that is compatible with the fastener material and the environment prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Reactor Head Closure Studs Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Reactor Head Closure Studs Program, and the applicant's responses to the RAIs, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff reviewed the exceptions and their justification, and finds that the exceptions were not warranted and that the AMP is adequate to manage the aging effects for which the LRA credits it. The staff identified an enhancement to the AMP and finds that with its implementation through commitment No. 3 prior to the period of extended operation, the existing program will be consistent with the GALL AMP with which it was compared. The staff concludes that the applicant has demonstrated that effects of 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 the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Flow-Accelerated Corrosion

Summary of Technical Information in the Application. LRA Section B.2.1.6 describes the existing Flow-Accelerated Corrosion program as being consistent with an exception with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

The applicant stated that this program provides for predicting, detecting, and monitoring wall thinning in piping, fittings, valve bodies, and feedwater heaters due to flow-accelerated corrosion. The applicant also stated that program activities include analyses to determine critical locations, baseline inspections to determine the extent of thinning at these critical locations, and follow-up inspections to confirm the predictions. The applicant also stated that inspections are performed using ultrasonic, radiographic, visual or other approved testing techniques capable of detecting wall thinning.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, remained adequate to manage the aging effects for which the LRA credits it.

In comparing the program elements in the applicant's program to those in GALL AMP XI.M17, the staff determined that those applicant's program elements for which the applicant claimed consistency with the GALL Report, are consistent, but the staff identified an issue with the "monitoring and trending" program element.

In the "monitoring and trending" program element, it was not clear to the staff what criteria the applicant used to determine when additional samples are required. GALL AMP XI.M17 recommends that results be evaluated to determine if additional inspections are needed. In RAI B.2.1.6-2, dated September 29, 2008, the staff requested that the applicant provide additional information relating to the criteria used to determine when additional samples are required.

In its response to the RAI dated October 20, 2008, the applicant stated that if any component has a current or projected wall thickness within the next operating cycle that is less than the minimum acceptable wall thickness, or if any component exhibits unexpected wall thinning, then sample expansion is required to bound the area of thinning. The applicant provided examples of increased sample scope, such as increasing the sample scope to include two pipe diameters downstream and upstream of degraded component, the two highest ranked components based on wear rate projections from the same train, and components of similar geometry in sister trains.

The applicant also stated that if the initial sample expansion inspection detects components with significant wear, then the inspection scope is further expanded until no additional components with significant wear are detected.

Based on its review, the staff finds the applicant's response to RAI B.2.1.6-2 acceptable because the applicant provided the criteria that are used to determine sample expansion. The staff finds that the sample expansion scope includes the appropriate locations to determine the extent of degraded components which is consistent with the recommendation of GALL AMP XI.M17 to evaluate the results of the inspection to determine if additional inspections are needed. The staff's concern described in RAI B.2.1.6-2 is resolved.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 specifies in XI.M17 that the program relies on implementation of the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center (NSAC)-202L-R2 for an effective FAC program. The TMI-1 FAC Program is based on the EPRI guidelines found in NSAC-202L-R3. The sections of NSAC-202L associated with the program elements were reviewed to show that revision 2 and 3 of the guidelines are equivalent with one difference: revision 3 allows an additional method for determining the wear of piping components from UT inspection. This method is called the Averaged Band Method. TMI-1 does not use this method at this time.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "preventive actions," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements.

The staff reviewed the applicant's program basis document that references procedure ER-AA-430, "Conduct of Flow Accelerated Corrosion Activities," which utilizes NSAC-202L-R2 as a guideline. In RAI B.2.1.6-1 dated September 29, 2008, the staff requested that the applicant provide additional information to clarify the discrepancy between the flow-accelerated corrosion activities procedure, which references NSAC-202L-R2 and the LRA exception, which references NSAC-202L-R3. The staff also requested that the applicant provide additional information to indicate if there are any plans to use the Averaged Band Method for determining the wear of piping components from UT inspections in the future, and if so, what additional controls will be put in place to utilize this method.

In its response to the RAI dated October 20, 2008, the applicant stated that the Flow Accelerated Corrosion Program will rely on the implementation of EPRI guideline NSAC-202L-R3 and the procedure ER-AA-430 will be revised to identify that the program is in accordance with EPRI guideline NSAC-202L-R3. The applicant also stated that it is currently transitioning to allow the use of the Averaged Band Method for determining wear of piping components from UT inspections as described in NSAC-202L-R3. Accordingly, the applicant amended the LRA to delete the last sentence of the exception that states, "TMI-1 does not use this method at this time," and replaced it with the following text:

> This method is a deviation of the Band Method and builds upon years of experience with the Band Method, which remains an option in NSAC-202L-R3 for determining the wear of piping components from UT inspection. Overly conservative methods can lead to unnecessary inspections or re-inspections. The Averaged Band Method provides a more accurate and less conservative estimate of pipe wear than the Band Method.

Based on its review, the staff finds the applicant's response to RAI B.2.1.6-1 acceptable and also finds the exception to the GALL Report acceptable because the applicant intends to use the Averaged Band Method as delineated in NSAC-202L-R3, for determining the wear of piping components from UT inspections. In addition, GALL AMP XI.M17 acknowledges that the program relies on implementation of EPRI guidelines in NSAC-202L-R2 for an effective flow-accelerated corrosion program and the staff notes that NSAC-202L-R3 provides another option of determining the wear of piping components from UT inspections. The staff notes that EPRI documents are created using industry experience over several years and finds that the Averaged Band Method will provide another method to determine the wear of piping components from UT inspections. The staff finds this method to be more accurate, thereby resulting in better prediction of remaining life and less rework. The staff finds the use of EPRI NSAC-202L-R3 acceptable. The staff's concern described in RAI B.2.1.6-1 is resolved.

<u>Operating Experience</u>. The staff reviewed the operating experience provided in LRA Section B.2.1.6 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that during the 2003 refueling outage, flow-accelerated corrosion (FAC) inspections of several components were found to have experienced wall-thinning. The applicant analyzed these components to establish a safe life expectancy for continued operation until 2005. These components were subsequently replaced in 2005. In addition, the applicant found some components were experiencing high wear rates and these components were replaced and changed to a resistant material in 2005. The applicant identified other instances of wall thinning in heater drain pump discharge lines and main feedwater pump recirculation lines. The applicant initiated appropriate corrective actions, which included replacing some piping.

The staff finds that the applicant's Flow-Accelerated Corrosion Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of flow-accelerated corrosion and can be expected to ensure that piping wall thickness will be maintained above the minimum required by design.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.6, provides the applicant's UFSAR Supplement for the Flow-Accelerated Corrosion Program. The staff confirmed that the UFSAR Supplement summary description for the Flow-Accelerated Corrosion Program conforms to the staff's recommended UFSAR Supplement for this program as found in SRP-LR Table 3.4-2.

In LRA Section A.5, Commitment No. 6, the applicant committed to implementation of the Flow-Accelerated Corrosion Program on an on-going basis during the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Flow-Accelerated Corrosion Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Flow-Accelerated Corrosion Program and the applicant's response to the RAIs, the staff finds 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 finds that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this program and concludes that the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Open-Cycle Cooling Water System

Summary of Technical Information in the Application. LRA Section B.2.1.9 describes the existing Open-Cycle Cooling Water System Program as being consistent, with an exception and an enhancement, to GALL AMP XI.M20, "Open-Cycle Cooling Water System."

The applicant stated that the program provides for management of aging effects in raw water cooling systems through tests and inspections per guidelines of NRC Generic Letter (GL) 89-13, "Service Water Problems Affecting Safety Related Components." The program primarily consists of GL 89-13 activities that include chemical and biocide injection, system testing, periodic inspections and NDE. The applicant also stated that the program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in Open-Cycle Cooling Water (OCCW) system components that are exposed to a raw water environment. The applicant also stated that procedures provide instructions and controls for preventive actions through raw water chemistry control (chemical and biocide injection), performance monitoring through station testing and condition monitoring, and leak detection through inspection and testing of raw water systems within the scope of license renewal.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception and the enhancement to determine whether the AMP, with the exception and the enhancement, remained adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M20, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 program scope consists of preventive measures to mitigate the aging effects of material loss and fouling due to micro- or macro-organisms and various corrosion mechanisms. The TMI-1 Open-Cycle Cooling Water System aging management program will also be used to manage the following aging effects and mechanisms for the internal surfaces of concrete circulating water piping:
>
> - Cracking and expansion due to reaction with aggregates
> - Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel
> - Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack
> - Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide
>
> The TMI-1 Open-Cycle Cooling Water System aging management program activities are adequate for managing the aging effects of the internal surfaces of concrete circulating water piping.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "parameters monitored/inspected," and "detection of aging effects," program elements.

The staff noted that the applicant has proposed the use of the Open-Cycle Cooling Water System Program to manage the aging of the concrete circulating water tunnel, which is similar to concrete structures for which the GALL Report recommends use of the Structures Monitoring Program and for which the GALL Report recommends further evaluation of the program if the Structures Monitoring Program is not used. In RAI B.2.1.9-1, dated September 29, 2008, the staff requested that the applicant provide additional information to support evaluating the adequacy of the Open-Cycle Cooling Water System Program to manage the additional aging effects for which the program is credited.

In its response to the RAI dated October 20, 2008, the applicant stated that the Open-Cycle Cooling Water System Program credits internal walkdown and inspections of the concrete circulating water piping and tunnels for license renewal. The applicant stated that the current conditions of the piping and tunnels are known and have been documented with photographs. The applicant stated that inspections performed during the Fall 2003 refueling outage identified degraded caulking at seven piping joints, and that inspections performed during the Fall 2005 refueling outage found no significant increase in degradation at those same seven joints and no degradation in other locations throughout the concrete piping and tunnels. The applicant stated that conditions of the degraded joints are documented and planned repairs are tracked in its corrective action program and that no other degradation has been identified throughout the concrete circulating water piping and tunnels. The applicant stated that the Structures Monitoring Program also credits the walkdown and inspection of the concrete circulating water tunnels and that internal inspection of the circulating water concrete tunnels, which requires drainage of the circulating water system, is required every five years by the Structures Monitoring Program.

In its response to the RAI, the applicant stated that internal inspection of the circulating water piping credited by the Open-Cycle Cooling Water System Program is performed when the circulating water system is drained, and that the system typically is drained every refueling outage to perform de-silting of the cooling tower basins. The applicant stated that this activity includes walkdown and general visual examination of the entire length of the piping and tunnels between the main circulating water pump discharge and the main condenser inlet and between the main condenser outlet and the natural draft cooling towers. The applicant stated that a general visual examination is utilized for detection of all aging mechanisms identified in the LRA for the internal surfaces of the concrete circulating water piping and tunnels.

The staff noted that the applicant has existing operating experience inspecting the circulating water tunnel and concrete piping to monitor for aging effects. The staff also noted that the aging effects being monitored manifest themselves in readily noticeable indications such as degraded pipe joint caulking and concrete surface damage or discoloration, and that visual inspection is adequate to detect degradation of the concrete components and structures. The staff further noted that current conditions of the circulating water tunnel and concrete piping are documented, and that any future age-related degradation can be identified and evaluated by comparison with the currently documented baseline conditions.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.9-1 acceptable and also finds the exception to the GALL Report acceptable because the applicant’s proposed inspection methodology and frequency is adequate to detect the aging effects of interest, and the components included in those inspections are part of the station’s open-cycle cooling water system. Additionally, the staff finds the applicant’s expansion of the OCCW System Program to include monitoring for additional aging effects to be acceptable. The staff’s concern described in RAI B.2.1.9-1 is resolved.

Enhancement. The LRA states an enhancement to the GALL Report as follows:

> A new river water chemical treatment system will be installed to treat the river water systems for biofouling, including microbiologically-influenced (MIC) corrosion.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the “scope of program,” “preventive actions,” and “acceptance criteria” program elements.

In LRA Section A.5, Commitment 9, the applicant committed to add the new river water chemical treatment system prior to the period of extended operation.

The staff noted that the change proposed by the applicant is not needed to cure a deficiency in the current program or to bring the current program into conformance with the recommendations for an Open-Cycle Cooling Water System Program as described in GALL AMP XI.M20. The staff noted that the applicant's current OCCW system design includes equipment to treat the river water systems for biofouling. However, the applicant stated that the existing river water treatment system has experienced some operational issues that will be eliminated by the new river water treatment system design.

Based on its review, the staff finds the applicant's proposed enhancement to be acceptable because the program elements in the applicant's Open-Cycle Cooling Water System Program that are affected by this enhancement will be consistent with the recommended program elements in GALL AMP XI.M20, and the addition of a river water treatment system that has improved operational features increases confidence that the applicant's program will successfully mitigate potential aging effects for components within its scope during the period of extended operation.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.9 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that guidance of NRC GL 89-13 has been implemented for approximately 10 years and has been effective in managing aging effects due to biofouling, corrosion, erosion, protective coating failure, and silting in structures and components serviced by the OCCW systems. The applicant stated that loss of material due to general, pitting, crevice and microbiologically-influenced corrosion, and fouling, reduction of heat transfer due to fouling, cracking and expansion due to reaction with aggregates, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are being adequately managed. The applicant provided the following three examples of site-specific operating experience to demonstrate effectiveness of the current Open-Cycle Cooling Water System Program:

(1) The applicant stated that in November 2001, eddy current testing on a closed cooling water heat exchanger resulted in identification of indications in 10 of 369 tubes inspected. Indications ranged from 21% to 50% through-wall with two indications greater than 45% through-wall. The applicant stated that the two tubes with the larger indications were plugged to reduce risk of possible leakage during the next operating cycle, and a root cause investigation found that 8 of the 10 tubes with indications were newly installed during the previous refueling outage. The applicant further stated that the investigation concluded that the most significant mode of degradation was under-deposit corrosion, based on the identification of silt in the lower half of the heat exchanger and that MIC and MIC-related ammonia-induced cracking was considered a contributing mode of degradation because seasonal ammonia was present in the river.

(2) The applicant stated that in June 2002, a through-wall leak was identified in the 30-inch circulating water pipe, and the leak size was estimated to be 1 gpm. The applicant stated

that indications on the surface of the pipe suggested MIC was the likely cause of the leak. The applicant further stated that technical evaluations concluded that the leak did not jeopardize the capabilities of the circulating water system, which provides cooling to the main condenser and the feedwater pump turbine condensers; and due to the orientation of the leak there was no potential impact on nearby equipment, including valve motor operators. The applicant stated that repairs of the pipe were completed in a subsequent outage.

(3) The applicant stated that in December 2005, a MIC-related leak was found in the cross-tie line between two OCCW subsystems and that the leak was in a carbon steel pipe in a low flow area. The applicant stated that ultrasonic testing (UT) was performed on the leak area and results showed acceptable wall thickness except at the location of the leak. The applicant stated that per ASME code case requirements, UT examinations were required every 90 days until the leak was repaired, that subsequent UT examinations showed no further degradation beyond the original failure; and the piping where the leak occurred was replaced during the outage in the fall of 2007.

The applicant stated that problems identified in the operating experience of the OCCW System Program would not affect safe operation of the plant, and adequate corrective actions were taken to prevent recurrence.

In addition to these examples, the staff reviewed the applicant’s operating experience discussion provided in the applicant’s license renewal program basis document binder for the Open-Cycle Cooling Water System Program. The staff reviewed additional selected corrective ARs related to the Open-Cycle Cooling Water System Program and interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

Based on this review, the staff finds (1) the OE demonstrates that the Open-Cycle Cooling Water System Program is achieving its objective of managing the aging effects of loss of material (without credit for protective coatings) and buildup of deposits (including fouling from biological, corrosion product, and external sources) in system components exposed to a raw water environment; and (2) that the applicant is taking appropriate corrective actions through implementation of the program.

The staff confirmed the “operating experience” program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.9 provides the applicant’s UFSAR Supplement for the Open-Cycle Cooling Water System Program. The staff confirmed that the applicant’s UFSAR Supplement summary description for this program conforms to the staff’s recommended UFSAR Supplement guidance found in SRP-LR Table 3.3-2.

In LRA Section A.5, Commitment No. 9, the applicant committed to credit the program for aging management during the period of extended operation and also committed to the program enhancement related to the installation of a new river water chemical treatment system prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Open-Cycle Cooling Water System Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Open-Cycle Cooling Water System Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and its justification and finds that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also reviewed the enhancement and its justification and finds that with its implementation through Commitment No. 9 prior to the period of extended operation, the existing program will be consistent with the GALL AMP with which it was compared. The staff also reviewed the response to RAI 2.1.9-1 and finds it acceptable. 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 the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Closed-Cycle Cooling Water System

Summary of Technical Information in the Application. LRA Section B.2.1.10 describes the existing Closed-Cycle Cooling Water System Program as being consistent, with an exception and an enhancement, to GALL AMP XI.M21, "Closed-Cycle Cooling Water System."

The applicant stated that this program provides aging management for loss of material and/or reduction of heat transfer in piping, piping components, piping elements and heat exchangers within the scope of license renewal that are in a closed cooling water environment. The applicant also stated that the program provides for preventive maintenance, performance monitoring and condition monitoring activities for affected components. The applicant further stated that performance monitoring provides indications of degradation in closed-cycle cooling water (CCCW) systems, with plant operating conditions providing indications of degradation in normally operating systems, and that station maintenance inspections and NDE provide condition monitoring of heat exchangers exposed to CCCW environments.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception and the enhancement to determine whether the AMP, with the exception and the enhancement, remained adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M21, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 refers to EPRI TR-107396 1997 Revision. TMI-1 implements the guidance provided in EPRI 1007820, which is the 2004 Revision to TR-107396. EPRI periodically updates industry water chemistry guidelines, as new information becomes available. TMI-1 has reviewed EPRI 1007820 and has determined that the most significant difference is that the new revision provides more prescriptive guidance and has a more conservative monitoring approach. EPRI 1007820 meets the same requirements of EPRI TR-107396 for

> maintaining conditions to minimize corrosion and microbiological growth in closed cooling water systems for effectively mitigating many aging effects.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "preventive actions," "parameters monitored/inspected," and "monitoring and trending," program elements.

The staff noted that in a previous staff review and comparison of EPRI TR-1007820 and EPRI TR-107396, the staff confirmed an applicant's assessment that a more recent revision to EPRI's Closed-Cycle Cooling Water Chemistry Guidelines provides more prescriptive guidance, has a more conservative monitoring approach, and meets the same recommendations for maintaining conditions to minimize corrosion and microbiological growth in CCCW systems.

Based on the previous staff review of EPRI TR-1007820 having found the more recent ERPI Closed Cycle Cooling Water Chemistry Guidelines to be acceptable as a basis for aging management of CCCW systems and components with more prescriptive and conservative guidance than the guidelines referenced in the GALL Report, the staff finds the applicant's exception to the GALL Report acceptable.

Enhancement. The LRA states an enhancement to the GALL Report as follows:

> A one-time inspection of selected components in stagnant flow areas will be conducted to confirm the absence of aging effects resulting from exposure to closed cycle cooling water. Also, a one-time inspection of selected CCCW chemical mix tanks and associated piping components will be performed to verify corrosion has not occurred on the interior surfaces of the tanks and associated piping components.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements.

In LRA Section A.5, Commitment No. 10, the applicant committed to implement the one-time inspections of CCCW components prior to the period of extended operation.

The staff noted that the enhancement is a one-time expansion of the Closed-Cycle Cooling Water System Program's inspection scope to include stagnant flow areas and additional components and that this enhancement is not needed to eliminate a deficiency in the applicant's current program or to bring the applicant's current program into conformance with recommendations for an acceptable Closed-Cycle Cooling Water System Program as described in the GALL Report AMP XI.M21. However, the additional one-time inspections proposed by the applicant will provide additional confirmation that CCCW chemistry is being controlled in such a way as to mitigate or prevent potential aging effects in components exposed to the treated water of the CCCW system.

Based on its review, the staff finds the applicant's proposed enhancement to be acceptable because the program elements in the applicant's Closed-Cycle Cooling Water System Program that are affected by this enhancement will be consistent with the program elements in GALL AMP XI.M21. In addition, the one-time inspection of stagnant flow areas and additional components will provide additional confirmation and increased confidence that the applicant's program mitigates and prevents potential aging effects for components within its scope during the period of extended operation.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.10 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that degradation of CCCW systems due to corrosion product buildup or through-wall cracks in supply lines has been observed in operating plants and that operating experience demonstrates the need for this program. The applicant stated that cracking due to stress corrosion cracking, loss of material due to general, pitting, crevice, and galvanic corrosion, and reduction in heat transfer due to fouling is being adequately managed by the existing program. The applicant provided the following three examples of site-specific operating experience to demonstrate effectiveness of the current Closed-Cycle Cooling Water System Program:

(1) The applicant stated that in February 2003, molybdate values fell below the minimum limit during a system flush of the decay heat closed cooling water system. The applicant stated that a planned system flush is needed periodically because the biocides used contribute to the chloride concentration in the system, and the chloride builds up after multiple biocide additions. The applicant further stated that molybdate concentration dropped below the minimum specified value for a short time during the nine-hour flushing process; however, an evaluation showed that the carbon steel was protected during the nine-hour period of time. The applicant stated that the system was protected during the flush and actions taken to minimize the out-of-specification time reduced risk of corrosion occurring because of the flush.

(2) The applicant stated that in December 2002 routine water chemistry monitoring identified high chloride concentration in three CCCW subsystems, and the ammonia level exceeded the plant administrative goal of 2.0 ppm for CCCW for the first time since 1995. The applicant stated that subsequent evaluation found that samples of two biocides routinely added to the subsystems, when mixed at normal treatment concentrations, tested positive for ammonia in concentrations similar to those measured in the three affected subsystems. The applicant stated that corrective actions included reducing ammonia levels in the CCCW subsystems to normal levels and improving the product evaluation and procurement procedures used for the purchase of new treatment chemicals.

(3) The applicant stated that in May 2002, weekly chemistry analysis of the CCCW system resulted in pH levels in three closed cooling subsystem below the specification limit. The applicant stated that chemistry recommendations were initiated to add sodium hydroxide to increase pH. The applicant further stated that follow-up testing showed the pH returned to acceptable levels and that there has been no occurrence of the CCCW system chemistry sample results being out of specification since 2003.

In addition to these examples, the staff reviewed the applicant's operating experience discussion provided in the applicant's license renewal program basis document binder for the Closed-Cycle Cooling Water System Program. The staff reviewed additional selected corrective Action Reports related to the Closed-Cycle Cooling Water System Program and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

Based on its review, the staff finds (1) that the operating experience for this program demonstrates that the applicant's Closed-Cycle Cooling Water System Program is achieving its objective of managing the aging effects of loss of material and/or reduction in heat transfer for piping, piping components, piping elements and heat exchangers that are within the scope of license renewal and exposed to a closed cooling water environment; and (2) that the applicant is taking appropriate corrective actions through implementation of this program.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.10 provides the applicant's UFSAR Supplement for the Closed-Cycle Cooling Water System Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 10, the applicant committed to credit the program for aging management of applicable components during the period of extended operation and also committed to the enhancement regarding the addition of a one-time inspection of selected CCCW components into the program.

The staff finds that the applicant has provided an adequate summary description of the Closed-Cycle Cooling Water System Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Closed-Cycle Cooling Water System program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and its justification and finds that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancement and confirms that with its implementation through Commitment No. 10 prior to the period of extended operation, the existing program will be consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.2.7 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Summary of Technical Information in the Application. LRA Section B.2.1.11 describes the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program as being consistent, with enhancements, to GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

The applicant stated that the program utilizes periodic visual inspections to manage aging effects for structural components of cranes and hoists including the bridge, trolley, rail system, structural bolting, and lifting devices in accordance with the provisions of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants."

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements to determine whether the AMP, with the enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M23, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent.

The enhancements include guidance requiring the visual inspection of rails for loss of material due to wear, structural bolts for loss of material due to general corrosion, and evaluation of significant loss of material due to wear of the rail.

Through its onsite review and discussions with the applicant, the staff noted that the program is implemented through procedures that are based on NRC approved guidance. Inspections are visual in nature, and are conducted on a routine basis for degradation, including annually for the reactor building crane and refueling platform, and bi-annually for diesel generator bridge cranes. Some more infrequently used cranes have an inspection frequency of either two years, or inspection prior to use.

Enhancement 1. The LRA states an enhancement to the GALL Report as follows:

> The program will be enhanced to require visual inspection of the rails in the rail system for loss of material due to wear.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program" and "parameters monitored/inspected" program elements.

The staff finds this enhancement acceptable because when implemented, the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be consistent with GALL AMP XI.M23 and will add assurance of adequate management of aging effects.

Enhancement 2. The LRA states an enhancement to the GALL Report as follows:

> The program will be enhanced to require visual inspection of structural bolts for loss of material due to general corrosion.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program" and "parameters monitored/inspected" program elements.

The staff finds this enhancement acceptable because when implemented, the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be consistent with GALL AMP XI.M23 and will add assurance of adequate management of aging effects.

Enhancement 3. The LRA states an enhancement to the GALL Report as follows:

> Acceptance criteria will be enhanced to require evaluation of significant loss of material due to wear of the rail in the rail system.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "acceptance criteria" program element.

The staff finds this enhancement acceptable because when implemented, the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be consistent with GALL AMP XI.M23 and will add assurance of adequate management of aging effects.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.11 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that a review of approximately 400 corrective action reports did not identify any history of loss of material due to corrosion in cranes or in hoist's structural members, or loss of material due to wear in the rail system. The staff reviewed the operating experience reports, including a sample of issue reports, to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In one report, the applicant stated that an event occurred in 2003, where cracks were discovered in 5 out of 16 pairs of diagonal braces on the reactor building polar crane. The applicant further stated that an engineering evaluation determined the diagonal braces were not needed for normal polar crane operation. The staff asked the applicant whether the diagonal braces would be needed for the planned steam generator replacement in 2009. The applicant responded to the question and stated that the reactor building polar crane will not be used for movement of the steam generators and that an auxiliary crane will be installed, partially supported by the polar crane rails, for movement of the steam generators. The staff reviewed the engineering evaluation for the auxiliary crane and finds it acceptable.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA section A.2.1.11 provides the applicant's UFSAR Supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, commitment No. 11 the applicant committed to credit the program for aging management during the period of extended operation and also committed to the program enhancements related to the visual inspection of rails and structural bolting for loss of material prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program the staff finds that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff reviewed the enhancements and related justification and finds that with their implementation through Commitment No. 11 prior to the period of extended operation, the existing program will be consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that intended 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 the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21 (d).

3.0.3.2.8 Compressed Air Monitoring

Summary of Technical Information in the Application. LRA Section B.2.1.12 describes the existing Compressed Air Monitoring Program as being consistent, with enhancements, with GALL AMP XI.M24, "Compressed Air Monitoring."

The applicant stated that this program provides for managing the internal surfaces of piping and components in a compressed air system for loss of material due to general, pitting and crevice corrosion, and the reduction of heat transfer due to fouling.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements to determine whether the applicant's program, with the enhancements is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M24, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, but several issues were identified for which the staff requested additional information.

GALL AMP XI.M24 states that the program manages the effects of corrosion and presence of unacceptable levels of contaminants on the intended function of the compressed air system. LRA Section B.2.1.12 states that the program manages loss of material due to corrosion and reduction of heat transfer due to fouling. In RAI B.2.1.12-1, dated September 29, 2008, the staff requested that the applicant provide additional information to explain how this program manages the effects of fouling and the resulting reduction of heat transfer.

In its response to the RAI dated October 20, 2008, the applicant stated that during the maintenance that is performed on instrument air aftercoolers every four years, the aftercoolers are disassembled and inspected for a number of attributes including: corrosion, scaling, slime or other coating of the tubes, the presence of silt or debris, and other forms of fouling. The applicant stated that if discrepancies are identified, then Issue Reports are initiated and corrective actions are taken.

Based on its review, the staff finds the applicant's response to RAI B.2.1.12-1 acceptable because the applicant stated that they visually inspect for fouling caused by silt, debris, and slime during the periodic disassembly and inspection of the aftercoolers. The staff confirmed that during disassembly, the internals of the aftercoolers are accessible and can be visually inspected and any fouling would be observed and identified for further corrective actions. The staff's concern described in RAI B.2.1.12-1 is resolved.

GALL AMP XI.M24, in the "monitoring and trending" program element states that test data is analyzed and compared to data from previous tests to provide for timely detection of aging effects. The applicant's program basis document for this program element stated that results of tests are compared to established acceptance criteria; however, it is not clear to the staff if these results are compared to previous test results to establish a trend. In RAI B.2.1.12-2, dated September 29, 2008, the staff requested that the applicant provide additional information to clarify this issue and discuss if the test results are also compared to previous test results for trending purposes.

In its response to the RAI dated October 20, 2008, the applicant stated that its Conduct of Plant Engineering Manual requires the system manager to maintain a system notebook that contains current and historical performance data, and analysis results, which are used by the system manager to trend the previous data along with the current data to identify any adverse trends or reductions in margin that may be indicative of aging.

Based on its review, the staff finds the applicant's response to RAI B.2.1.12-2 acceptable because the applicant states that they compare previous results to establish any adverse trends or reductions in margin that may be indicative of aging. Additionally, the staff noted that this comparison to historical results is performed for all systems, including the compressed air system. The staff's concern described in RAI B.2.1.12-2 is resolved.

Enhancement 1. The LRA states an enhancement to the GALL Report as follows:

> The Compressed Air Monitoring program will be enhanced to include instrument air system air quality testing for dew point, particulates, lubricant content, and contaminants to ensure that the contamination standards of ANSI/ISA-S7.0.01-1996, paragraph 5 are met. These enhancements will be made to the existing program GL 88-14 Instrument Air Program.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program," "preventive actions," and "parameters monitored/inspected," program elements.

GALL AMP XI.M24 states that system air quality is monitored and maintained in accordance with plant owners testing plans, which are prepared from guidelines based on industry standards. One of the industry standards identified in the GALL AMP is ISA-S7.0.01-1996.

Based on its review, the staff finds this enhancement to be acceptable because when implemented, it will make the Compressed Air Monitoring Program consistent with the GALL Report.

Enhancement 2. The LRA states an enhancement to the GALL Report as follows:

> In addition the Compressed Air Monitoring program will be enhanced to include air sampling activities on a representative sampling of headers on a yearly basis in accordance with ASME OM-S/G-1998, Part 17 and EPRI TR-108147.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the “scope of program,” “preventive actions,” and, “detection of aging effects,” program elements. GALL Report AMP XI.M24 states that guidelines in EPRI TR-108147 and ASME OM-S/G-1998, Part 17, ensure timely detection of degradation of the compressed air system function.

Based on its review, the staff finds this enhancement acceptable because when implemented, it will make the Compressed Air Monitoring Program consistent with the GALL Report.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.12 and also interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the performance of air dryers is actively monitored and maintained within acceptance criteria as evidenced by system reports initiated between April and June 2004, and that when the instrument air quality is not within acceptance limits, corrective actions are immediately taken to resolve the condition. The applicant also stated that examples of leakage in the instrument air system were reported in several Issue Reports initiated from April 2002 to October 2003, and appropriate corrective actions were implemented in each case.

The staff reviewed issue reports as part of the operating experience review during the audit and found that the applicant had identified degradation in an instrument air dryer and identified a failed transmitter on an instrument air dryer. The applicant had taken appropriate corrective actions in each case to resolve the issues.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds the program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.12, the applicant provided the UFSAR Supplement for the Compressed Air Monitoring Program. The staff confirmed that the applicant’s UFSAR Supplement summary description for this program conforms to the staff’s recommended UFSAR Supplement for this type of program as found in SRP-LR Table 3.3-2.

In LRA Section A.5, Commitment No. 12, the applicant committed to the enhancements regarding instrument air system air quality testing for dew point, particulates, lubricant content, and contaminants; and air sampling activities on a representative sampling of headers on a yearly basis, prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Compressed Air Monitoring Program in the UFSAR Supplement as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant’s Compressed Air Monitoring Program, and the applicant’s response to the RAIs, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 12 prior to the period of extended operation will make the existing AMP consistent with GALL AMP XI.M24. 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 the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fire Protection

Summary of Technical Information in the Application. LRA Section B.2.1.13 describes the existing Fire Protection Program as being consistent with an exception, and enhancements, with GALL AMP XI.M26, “Fire Protection.”

The applicant stated that this program provides for visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and fire doors; periodic surveillance testing of fuel oil lines for the diesel driven fire pumps; and visual inspection of external surfaces of halon and carbon dioxide ($CO_{2)}$ fire suppression system components. The applicant stated that this program manages the aging effects of change in material properties, cracking, hardening and loss of material.

Staff Evaluation. During its audit and review, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff reviewed the exception and the enhancements to determine whether the program, with the exception and enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant’s program to those in GALL AMP XI.M26, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff identified issues with the “detection of aging effects” program element and the “acceptance criteria” program element for which the staff requested additional information.

The “detection of aging effects” program element of GALL AMP XI.M26, states that visual inspections of halon/CO_2 systems detects any sign of degradation, such as corrosion, mechanical damage, or damage to dampers. The applicant’s program basis document references plant surveillance procedures that do not clearly state that systems should be inspected for corrosion, mechanical damage or damage to dampers. In RAI B.2.1.13-1, dated September 29, 2008, the staff requested that the applicant provide additional information regarding the basis for not providing an enhancement to the program to provide for these inspections.

The “acceptance criteria” program element of GALL AMP XI.M26, states any signs of corrosion and mechanical damage of the halon/CO_2 fire suppression system are not acceptable. The staff determined that there is no acceptance criteria specified for the inspection parameters in the surveillance procedures that are referenced in the program basis document for halon/carbon dioxide systems. In RAI B.2.1.13-2, dated September 29, 2008, the staff requested that the applicant provide additional information as to why there was not an enhancement to the program to provide for the acceptance criteria for the inspection of these system components.

In its response to the RAI dated October 20, 2008, the applicant stated that the program basis document directs halon and CO_2 fire suppression system surveillance that verifies system operation including associated dampers, and identifies adverse conditions such as corrosion, broken or missing parts, loose fasteners, excessive dirt or debris, or other degrading condition for corrective action evaluation. The applicant further stated that although the halon system and CO_2 system implementing surveillance procedures require that conditions that could adversely affect equipment operation such as those stated in the program basis document be identified for evaluation, these procedures will be enhanced with clarifying reinforcement assuring inspection specifically for the GALL Report aging mechanisms of corrosion, mechanical damage or damage to dampers.

In its response to the RAI dated October 20, 2008, the applicant stated that the “limits and precautions” sections of these implementing procedures currently state that detection of any of these conditions require evaluation for corrective action. The applicant further stated that these procedures will be clarified to state specifically that that the results of inspection for corrosion and mechanical damage be evaluated, with corrective action taken as appropriate.

The applicant also stated that these clarifications to be added to the implementing procedures are not considered enhancements to the program because the program currently directs inspection of any adverse conditions such as corrosion, broken or missing parts, loose fasteners, excessive dirt or debris, or other degrading condition. However, as a result of these clarifying additions, the applicant revised LRA, Appendix A, Table A.5, Commitment No. 13, by adding the following statement:

> In addition, implementing surveillance procedures for Halon and CO_2 suppression systems will specifically require inspection for corrosion, mechanical damage, or damage to dampers, and will include acceptance criteria stating that detected signs of corrosion or mechanical damage be evaluated, with corrective action taken as appropriate.

Based on its review, the staff finds the applicant’s responses to RAIs B.2.1.13-1 and B.2.1.13-2 acceptable because the program basis document includes inspection for corrosion and mechanical damage and also finds that enhancements to the program are not necessary. The staff also finds that the revision to Commitment No.13 to revise the implementing procedures to specifically include these inspections and acceptance criteria is acceptable, because these revisions will make the applicant’s program consistent with GALL AMP XI.M26. The staff’s concerns discussed in RAIs B.2.1.13-1 and B.2.1.13-2 are resolved.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 recommends visual inspection and functional testing of the halon and CO_2 fire suppression systems at least once every six months. Procedurally, the TMI-1 halon fire suppression system currently undergoes operational testing and inspections every 18 months, and the TMI-1 low pressure CO_2 fire suppression system undergoes operational testing and inspections every 24 months. Additionally, the halon fire suppression system undergoes more frequent visual inspections for system charge (storage tank pressure at least every 3 months, and storage tank weight at least every 6 months), and the low-pressure carbon dioxide fire suppression system undergoes a visual storage tank level and pressure check at least weekly. These test frequencies are considered sufficient to ensure system availability and operability based on the station’s operating history that shows no aging related events that have adversely affected system operation.
>
> Similar exceptions to the NUREG-1801 recommended frequency for periodic function test of the halon and CO_2 fire suppression systems were previously approved by the NRC in NUREG-1796, Safety Evaluation Report Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2, and in NUREG-1875, Safety Evaluation Report Related to the License Renewal of Oyster Creek Generating Station. In each case for these plants, periodic functional testing

of the halon and CO_2 fire suppression systems is currently performed every 18 months. (Additionally, for Dresden and Quad Cities, the Technical Requirements Manual permits a testing frequency of once every two years.) The NRC staff found that on the basis of plant experience, the testing frequency was adequate for aging management considerations. For these plants, as for TMI- 1, station operating history indicated that there were no occurrences of aging related events having adversely affected system operation. A review of the functional surveillance tests performed for the TMI-1 halon and CO_2 systems within the last five years confirmed that there have been no occurrences of aging related events that adversely affected either system's operation.

The December 2006 halon system functional test was completed with all steps satisfactory after an evaluation of a repeated switch actuation required for multiple fan start determined that the switch had not been manually operated properly for the test. No occurrence of any aging related degradation having adversely affected the system's operation was observed. The June 2005 halon system functional was completed with all steps satisfactory. No occurrence of any aging related degradation having adversely affected the system's operation was observed. During the February 2004 halon system functional test, a fan motor failed and required replacement, and a valve limit switch required adjustment to properly indicate the associated valve was fully open. No occurrence of any aging related degradation of passive components having adversely affected the system's operation was observed.

The November 2005 CO_2 system functional test was completed with all steps satisfactory. Although an evaluation determined that a damaged fire damper grill was redundant and did not require replacement, the primary grill for the damper is functional for foreign material exclusion and the damper and system are operable. No occurrence of any degradation of passive components due to aging having adversely affected the system's operation was observed. During the November 2003 CO_2 system functional test, an electro-thermal link did not fully melt, causing a damper to not fully close. The link was replaced and the test re-performed satisfactorily. A CO_2 tank level was found low due to performance of a test and was subsequently re-filled. No occurrence of any aging related degradation having adversely affected the system's operation was observed. The October 2001 CO_2 system functional test was competed with all steps satisfactory. No occurrence of any aging related degradation having adversely affected the system's operation was observed.

On the basis of TMI-1 plant experience that no occurrence of any aging related degradation having adversely affected either the halon or the CO_2 systems' operation has been observed, the test frequencies are considered sufficient to ensure system availability and operability, and are adequate for aging management considerations.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "parameters monitored/inspected," and "detection of aging effects," program elements.

The staff reviewed the applicant's program basis document and the CLB, including the UFSAR and the Technical Requirements Manual, and noted that the frequencies for halon/carbon dioxide system tests are as identified in the LRA Section B.2.1.13. The staff also reviewed the applicant's operating experience report and did not find any age related degradation in the halon/carbon dioxide systems.

Based on its review, the staff finds the exception to the GALL Report acceptable because the applicant is (1) performing functional tests in accordance with its CLB, (2) performing more frequent visual inspections at intervals of every three to six months of the halon fire suppression system, (3) performing weekly visual inspections of carbon dioxide system storage tank level and pressure, and (4) based on the plant-specific operating experience, the staff finds that these inspection and testing frequencies are adequate to ensure the systems maintain their function.

Enhancement 1. The LRA states an enhancement to the GALL Report as follows:

> The program will provide for additional inspection criteria for degradation of fire barrier walls, ceilings, and floors.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements.

The "parameters monitored/inspected" program element of GALL AMP XI.M26, recommends that visual inspection of the fire barrier walls, ceilings, and floors examine any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates.

Based on its review, the staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 2. The LRA states an enhancement to the GALL Report as follows:

> The program will provide specific fuel supply line inspection criteria for diesel-driven fire pumps during tests.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and, "acceptance criteria" program elements.

The "acceptance criteria" program element of GALL AMP XI.M26, recommends that no corrosion is acceptable in the fuel supply line for the diesel-driven fire pump. In its response to RAI B.2.1.13-1, the applicant stated that acceptance criteria will include a statement that detected signs of corrosion or mechanical damage be evaluated, with corrective action taken as appropriate.

Based on its review, the staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.13 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff also reviewed the applicant's operating experience discussion that was provided in the applicant's license renewal basis document for the Fire Protection Program. The staff reviewed a sample of issue reports and confirmed that the applicant had identified age related degradation and implemented appropriate corrective actions.

The applicant provided several examples of its plant operating experience in LRA Section B.2.1.13 such as, degraded condition of fire door seal plate; repeated fire door latch failures; missing fasteners form metal plate closures on fire walls; and degraded seal in the floor of the control room. In all cases, the applicant evaluated the extent of the problem and took appropriate corrective action, including repair and replacement.

Furthermore, the staff confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report. The staff finds that the applicant's Fire Protection Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of age related degradation in fire protection system components and structures.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.13 provides the applicant's UFSAR Supplement for the Fire Protection Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found the SRP-LR.

In LRA Section A.5, Commitment No. 13, the applicant committed to the program enhancements related to the additional inspection criteria for degradation of fire barrier walls, ceilings, and floors; and the specific fuel supply line inspection criteria for diesel-driven fire pumps during tests prior to the period of extended operation.

In a letter dated October 20, 2008, the applicant revised Commitment No. 13 to state that prior to the period of extended operation, implementing surveillance procedures for Halon and CO_2 suppression systems will specifically require inspection for corrosion, mechanical damage, or damage to dampers, and will include acceptance criteria stating that detected signs of corrosion or mechanical damage be evaluated, with corrective action taken as appropriate.

The staff finds that the applicant has provided an adequate summary description of the Fire Protection Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fire Protection Program, and the applicant's response to the RAIs, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff reviewed the exception and its justification and finds that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also reviewed the enhancements and confirmed that their implementation through Commitment No. 13 prior to the period of extended operation will make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Fire Water System

Summary of Technical Information in the Application. LRA Section B.2.1.14 describes the existing Fire Water System Program as being consistent, with enhancements, with GALL AMP XI.M27, “Fire Water System.”

The applicant stated that this program manages aging effects for the water-based fire protection system and associated components through the use of periodic inspections, monitoring, and performance testing and provides for preventive measures and inspection activities to detect aging effects prior to loss of intended functions.

Staff Evaluation. During its audit and review, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff reviewed the enhancements to determine whether the program, with the enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant’s program to those in GALL AMP XI.M27, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff identified an issue with the “acceptance criteria” program element for which the staff requested additional information.

The “acceptance criteria” program element of GALL AMP XI.M27, states that no biofouling exists in the sprinkler systems that could cause corrosion in the sprinkler heads. In the applicant’s Fire Water System Program basis document, the applicant stated that new inspection activities will include an evaluation of identified fouling. During the audit, the applicant indicated that non-intrusive testing techniques such as ultrasonic testing will be used. In RAI B.2.1.14-1, dated September 29, 2008, the staff requested that the applicant provide additional information to clarify how the new ultrasonic examination activity will evaluate fouling.
In its response to the RAI dated October 20, 2008, the applicant stated the following:

> The volumetric non-intrusive examination activities include an evaluation of identified degradation for impact on the system or component function. In accordance with the corrective action process for deficiencies determined to be significantly adverse to quality, the cause of the condition is determined. The aging effect of loss of material can be caused by the aging mechanism of fouling. Fouling would therefore be considered and evaluated as a potential cause of loss of material in fire water service piping. Volumetric examinations do not directly determine fouling as an aging mechanism; however, they provide evidence of the aging effect of loss of material that may result from the aging mechanism of fouling.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.14-1 acceptable because the applicant is using a volumetric examination to detect loss of material, and the results would be evaluated by the corrective action process to determine the cause. The staff determines that one of the causes could be fouling in the sprinkler heads, which the applicant considers a potential cause for loss of material. The staff finds that the volumetric examination would detect fouling indirectly as a cause for corrosion and loss of material, and would therefore make the program consistent with the “acceptance criteria” program element. The staff’s concern described in RAI B.2.1.14-1 is resolved.

Enhancement 1. The LRA states an enhancement to the GALL Report as follows:

> Periodic non-intrusive wall thickness measurements of selected portions of the fire water system at intervals that do not exceed every 10 years.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "preventive actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements.

GALL AMP XI.M27 recommends that wall thickness evaluations of fire protection piping be performed at plant-specific intervals using non-intrusive techniques to identify evidence of loss of material due to corrosion.

Based on its review, the staff finds the enhancement acceptable because it will make the Fire Water System Program consistent with the GALL Report.

Enhancement 2. The LRA states and enhancement to the GALL Report as follows:

> Sampling of sprinklers in accordance with National Fire Protection Association (NFPA) Standard 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," and submitting the samples to a testing laboratory prior to the sprinklers being in service 50 years. Subsequent testing is at intervals that do not exceed every 10 years.

GALL AMP XI.M27 recommends testing or replacement of sprinkler heads in service for 50 years.

Based on its review, the staff finds the enhancement acceptable because it will make the Fire Water System Program consistent with the GALL Report.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.14 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

LRA Section B.2.1.14 provides several specific examples of plant operating experience. The applicant stated that following a test run and shut down of the diesel-driven river fire pump in 2005, fire service system pressure lowered until the motor-driven river fire pump auto-started on low fire service header pressure. An investigation indicated an underground piping leak was the cause and subsequently isolated and repaired. The applicant also stated that during performance of fire protection system operations surveillance in 2005, a leak was identified on a threaded elbow. The applicant quantified the leak, evaluated the cause of the leak that turned out to be due to MIC, and determined that it did not impact UFSAR-described or Technical Specification functions, and was not reportable. The applicant subsequently repaired the leak. The applicant also stated that two NRC-conducted triennial fire protection inspections were performed in 2002 and 2005, and only three very low significance findings were identified in the two inspections.

During the audit, the staff noted that Issue Report 748645 was issued by the applicant on April 11, 2008, to document corrosion and possible leakage of fire protection piping. In the report, the cause was determined to be heavy tuberculation of MIC causing excessive internal pitting. Issue

Report 635626 issued in 2005 indicates that ineffective mitigation of MIC in fire service water system has resulted in degradation of piping, including some through wall leaks.

The “preventive actions” program element of the GALL Report AMP XI.M27, states that to ensure no significant corrosion, MIC, or biofouling has occurred in water-based fire protection systems, periodic flushing, system performance testing, and inspections are conducted.
The staff noted that the program basis document states that flow tests are conducted once every three years and that these flow tests are intended to provide for an indication of internal piping degradation or fouling. However, based on the above identified issue report, these periodic flow tests may not be adequate. In RAI B.2.1.14-2, September 29, 2008, the staff requested that the applicant provide additional information to identify what preventive measures besides periodic flow testing are proposed to ensure that aging degradation due to MIC is adequately managed during the period of extended operation such that component intended functions are maintained.

In its response to the RAI dated October 20, 2008, the applicant stated that in accordance with plant procedures, the fire water system main header is flushed at least once every 12 months; the fire water system deluge and sprinkler systems located in clean areas are flushed once per 18 months; and, in radiation areas the fire water system deluge and sprinkler systems are flushed once per refueling cycle. The applicant also stated that inspection activities include the initiation of periodic non-intrusive fire protection piping wall thickness measurements. The applicant further stated that evaluation of degraded conditions includes determination of where MIC would be considered as a mechanism for loss of material. The applicant also stated that chemical treatment of circulating water has been conducted for approximately 5 years and chemical treatment of river water has been conducted for approximately 1 year. The applicant’s implementation of the new water chemistry plan has significantly reduced the number of new MIC leaks per year in circulating water piping. The applicant indicated that the fire service piping identified in this issue report was replaced in November of 2008.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.14-2 acceptable because the applicant is performing the necessary flushes at periodic intervals to ensure the system is clean of biofouling, has initiated new wall thickness examinations, and has implemented chemical treatment of circulating water and river water, which has reduced number of new MIC leaks per year. The applicant is also replacing the circulating water system piping where these leaks were observed. The staff reviewed the operating experience report and noted that the incidence of MIC related leaks has decreased over the last two years under the new water chemistry plan. The staff also finds that the Fire Water System Program will manage the aging effect of loss of material during the period of extended operation because the applicant has implemented additional measures to ensure that aging degradation due to MIC is managed and that piping with the old MIC leaks have been replaced. The staff’s concern described in RAI B.2.1.14-2 is resolved.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.14 provides the applicant’s UFSAR Supplement for the Fire Water System Program. The staff confirmed that the applicant’s UFSAR Supplement summary description for this program conforms to the staff’s recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 14, the applicant committed to enhance its program to require testing or replacement of sprinkler heads in service for 50 years, and to perform periodic non-intrusive wall thickness measurements of selected portions of the fire water system at intervals not exceeding 10 years prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Fire Water System Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fire Water System Program, and the applicant's response to the RAIs, the staff finds 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 through Commitment No. 14 prior to the period of extended operation will make the existing AMP consistent with the GALL AMP to which it was compared. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Aboveground Steel Tanks

Summary of Technical Information in the Application. LRA Section B.2.1.15 describes the existing Aboveground Steel Tanks Program as being consistent, with an exception and enhancements, to GALL AMP XI.M29, "Aboveground Steel Tanks."

The applicant stated that this program is credited to manage loss of material aging effects for those tanks that are fabricated of carbon steel and located outdoors. The applicant further stated that as part of this program, periodic visual inspections will be performed to monitor for any degradation of paint, sealant at the tank-foundation interface, and potential loss of material of the underlying metal. The applicant will enhance its existing implementing procedures to perform a one-time UT inspection on the bottom of the applicable tanks that are located on a concrete foundation in order to confirm that degradation has not occurred.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception and enhancements to determine whether the AMP, with the exception and enhancements is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M29, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent. The staff identified issues with the "scope of program," program element, and portions of other program elements related to the exception and enhancements for which the staff requested additional information.

The staff noted that in the applicant's program basis document under the program description and "scope of program" program element, the outdoor carbon steel tanks that are within the scope of this program include only the Condensate Storage Tank, Fire Service Water Head Tank (Altitude Tank), and the Sodium Hydroxide Tank. Each of these tanks is fabricated from carbon steel. Upon review of the applicant's aging management review line items, the staff noted that this AMP was credited for aging management of the Sodium Thiosulfate Tank which is fabricated from stainless steel. In RAI B.2.1.15-1, dated September 29, 2008, the staff requested that the applicant provide additional information to clarify whether this AMP is credited for aging management for aboveground steel tanks fabricated of carbon steel and stainless steel and whether the Sodium Thiosulfate Tank requires a one-time UT inspection of the bottom of the tank.

In its response to the RAI dated October 20, 2008, the applicant stated that this program is only intended for aboveground tanks fabricated from steel, and that aboveground stainless steel tanks, including the Sodium Thiosulfate Tank, are not within the scope of this program. The applicant further stated that an error was made in LRA Table 3.2.2-5, when the Aboveground Steel Tanks Program was credited for aging management of the Sodium Thiosulfate Tank. The staff confirmed that the applicant had sufficiently described the details of the amendment to this AMR line item.

Based on its review, the staff finds the applicant's response to RAI B.2.1.15-1 acceptable because the applicant has identified that the AMP should not have been credited for aging management of the aboveground stainless steel tanks. Additionally, the applicant amended the LRA to credit the appropriate AMP to manage the aging effect of loss of material for the Sodium Thiosulfate Tank. The staff's concern described in RAI B.2.1.15-1 is resolved.

Exception 1. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 states that periodic plant system walkdowns each outage are used to monitor degradation. The TMI-1 program utilizes tank inspections at least every five years in place of periodic system walkdowns each outage. Tank components subject to outdoor air are constructed from carbon steel. The carbon steel tanks are protected by a protective coating. Industry guidance and experience indicate that monitoring of exterior surfaces of components made of this material and protective coating on a frequency of at least every five years provides reasonable assurance that loss of material will be detected before an intended function is affected.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending" program elements.

GALL AMP XI.M29 states that based on operating experience system, walkdowns during each outage will provide for timely detection of aging effects. The LRA states that this exception to GALL is being taken based on industry guidance and industry operating experience. The staff determined that additional information was needed pertaining to the industry guidance and industry experience relied upon by the applicant for this exception. In RAI B.2.1.15-3, dated September 29, 2008, the staff requested the applicant provide additional information to clarify the current inspection frequency of all tanks within the scope of this program. The staff also asked the applicant to provide the detailed industry guidance and industry experience that is referred to in the exception and to justify the basis for not performing walkdowns each refueling outage as recommended by GALL AMP XI.M29.

In its response to the RAI dated October 20, 2008, the applicant stated that inspection frequency for all carbon steel tanks that are within the scope of License Renewal will be five years. The applicant further stated that this five-year frequency is consistent with its Structures Monitoring Program, for external surfaces of the tanks' supporting structures and with industry guidelines as stated on page 5-30 of SAND96-0343, "Aging Management Guideline for Commercial Nuclear Power Plants – Tanks and Pools," that have been proven to be effective in detecting loss of material prior to loss of intended functions. In its supplemental response to the RAI dated December 5, 2008 the applicant stated that the five-year frequency is consistent with

Maintenance Rule (10 CFR 50.65) requirements. The staff noted that the applicant's Structures Monitoring Program was developed based on guidance in RG 1.160, Revision 2, and NUMARC 93-01, Revision 2, to satisfy the requirement of 10 CFR 50.65.

Based on its review, the staff finds the applicant's response to RAI B.2.1.15-3 acceptable and also finds the exception to the GALL Report acceptable because the five-year frequency is consistent with the inspections performed as part of the Structures Monitoring Program which meets the requirements of 10 CFR 50.65. The staff's concern described in RAI B.2.1.15-3 is resolved.

Enhancement 1. The LRA states an enhancement to the GALL Report as follows:

> The existing TMI-1 Aboveground Steel Tanks program implementing procedures will be enhanced to include one-time thickness measurements of the bottom of the Condensate Storage Tanks, which are supported on concrete foundations. Measurements will be taken to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements.

The staff noted that of the aboveground steel tanks in the scope of this program only the Condensate Storage Tanks require a one-time UT inspection of the bottom of the tank to determine its condition. Additionally, the staff noted that the remaining tanks within the scope of the program, (the Fire Service Water Tank (Altitude Tank) and the Sodium Hydroxide Tank), are not directly supported by a concrete foundation and therefore, the one-time UT inspection is not required because a visual inspection of the tank bottom can be performed during tank inspections.

Based on its review, the staff finds the enhancement acceptable because performing this thickness measurement is consistent with GALL AMP XI.M29.

Enhancement 2. The LRA states an enhancement to the GALL Report as follows:

> The program will also be enhanced to inspect the condition of the sealant between CSTs and the concrete foundations.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending" program elements.

The staff determined that additional information was needed regarding the inspection of the sealant (concrete grout) at the tank to foundation interface. The staff noted that this program is being credited for aging management of the sealants/caulking and paint/coatings that are used on the aboveground steel tanks. However, based on the staff's review of the AMR line items in LRA Section 3, the staff noted that this AMP has not been credited for aging management of these materials. In RAI B.2.1.15-2, dated September 29, 2008, the staff requested the applicant provide additional information to clarify whether paints/coatings used on the external surface of the tanks and sealants/caulking used at the tank-foundation interface will be inspected as part of the AMP. The applicant was also requested to provide additional information to indicate the program that is credited for aging management of paint/coatings on the external surface and sealants and caulkings at the tank-foundation interface if this AMP is not credited.

In it response to the RAI dated October 20, 2008, the applicant stated the Condensate Storage Tanks are the only tanks managed by this AMP that are supported by a concrete foundation and have sealant (concrete grout) at the tank to foundation interface. The applicant also stated that the application and presence of the caulking/sealants and paints/coatings are design features and serve as only preventative measures for onset of corrosion. The staff noted that the applicant has not credited paints/coatings and caulking/sealants as they do not perform any intended function and are not within the scope of license renewal. However, the staff noted that as part of the visual inspection performed as part of this AMP, the applicant will inspect the condition of the paint/coatings and the condition of the sealant at the tank to foundation interface which will provide an indication of the condition of the underlying carbon steel material.

Based on its review, the staff finds the applicant's response to RAI B.2.1.15-2 acceptable because (1) the applicant has not credited paints/coatings and caulking/sealants with preventing and mitigating aging of the Condensate Storage Tanks, and therefore they do not require aging management and (2) the applicant will perform periodic visual inspections of the paints/coatings and caulking/sealants of these tanks which will provide an indication of the condition of the underlying metallic material, even though these design features do not perform an intended function and are not in the scope of License Renewal. The staff's concern described in RAI B.2.1.15-2 is resolved.

Based on its review, the staff finds the enhancement acceptable because it is consistent with the recommendations provided in GALL AMP XI.M29.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.15 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff noted that on June 13, 2005, the applicant discovered blistering and missing paint on the Altitude Tank, although there was no indication of rust or leaks. The applicant initiated a recurring task to inspect this tank on an annual basis to ensure that further degradation would not occur without it being discovered. The staff reviewed the inspection results from June 2007, and noted that the applicant found the tank did not have significant corrosion and had not further degraded from the previous year's inspection.

The staff noted that during an inspection of the Altitude Tank in June 2007 that pieces of insulation were discovered missing from piping locations on the upper and lower platform level. During this inspection the applicant noted mild to no rust conditions in the areas where the insulation was missing. The staff noted the results from the latest inspection in June 2008, which indicated the corrosion on the tank where the insulation is missing is not significant. The staff noted that the work to address the missing insulation is planned to occur during the next refueling outage scheduled for Fall of 2009. The staff also noted that the Altitude Tank will be capable of performing its intended functions until the scheduled work to replace the missing insulation is conducted during the Fall 2009 refueling outage because of the minimal degradation that was present based on recent inspections of these locations. The staff further noted that the applicant has been capable of identifying corrosion, has taken corrective actions to inspect this tank yearly to trend any degradation and has work scheduled to address the missing insulation.

Based on its review, the staff finds (1) that the operating experience for this AMP demonstrates that the AMP is achieving its objective of managing system components; and (2) that the applicant is taking appropriate corrective actions through implementation of this AMP.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.15 provides the applicant's UFSAR Supplement for the Aboveground Steel Tanks Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 15, the applicant committed to enhancing the existing program by revising the implementing procedure to include a one-time UT measurement of the CSTs bottoms and by inspecting the sealant at the tank-foundation interface prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Aboveground Steel Tanks Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Aboveground Steel Tanks Program, and the applicant's responses to the RAI's, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and the associated justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also reviewed the enhancements and confirmed that with their implementation, through Commitment No. 15 prior to the period of extended operation, the existing program will be consistent with the GALL AMP with which it was compared. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Fuel Oil Chemistry

Summary of Technical Information in the Application. LRA Section B.2.1.16 describes the applicant's existing Fuel Oil Chemistry Program as being consistent, with exceptions and enhancements, to GALL AMP XI.M30, "Fuel Oil Chemistry."

The applicant stated that the program provides preventive actions that maintain contaminants, such as water, particulate and sediment, in fuel oil systems at acceptable levels. The applicant also stated that contaminants are controlled and monitored in accordance with site technical specifications and applicable American Society for Testing and Materials (ASTM) standards and that the program manages loss of material due to general, pitting, crevice corrosion microbiologically-influenced corrosion, and biological fouling.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions and enhancements to determine whether the AMP, with the exceptions and enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M30, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent.

Exception 1. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 states in XI.M30 that the fuel oil aging management program is focused on managing the conditions that cause general, pitting, and microbiologically-influenced corrosion (MIC). The TMI-1 aging mechanisms in fuel oil also include the loss of material due to crevice corrosion and biological fouling. The contaminants that cause crevice corrosion and biological fouling are similar to those that cause general, pitting and microbiologically-influenced corrosion (MIC). Therefore, the monitoring and inspection techniques used to manage the conditions that cause general, pitting, and microbiologically-influenced corrosion (MIC) will be effective in managing the loss of material due to crevice corrosion and biological fouling.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," and, "monitoring and trending" program elements.

The "scope of program" element of GALL AMP XI.M30, states that the program is focused on managing the conditions that cause general, pitting, and MIC of the diesel fuel tank internal surfaces. Fouling and crevice corrosion are not specifically included as an aging mechanisms managed by GALL AMP XI.M30. The staff noted that water, sediment, and particulate contamination of fuel oil could cause loss of material due to general corrosion, pitting, and MIC. The staff notes that these contaminants can also lead to fouling and crevice corrosion. In addition, monitoring and maintaining contamination (water and particulate) below acceptable levels in fuel oil systems and periodic cleaning of tanks will be effective methods to manage biological fouling because these contaminants are necessary for biological fouling to occur. The staff also noted that water, particulate, and sediment can cause crevice corrosion, which can occur in localized areas where contaminants can be trapped, leading to degradation similar to pitting corrosion and controlling contaminant levels, periodic cleaning and visual inspection of fuel oil tanks are effective means to minimize and detect crevice corrosion. Therefore, the staff finds that the contaminants that cause general, pitting, and MIC can also cause crevice corrosion and biological fouling and the methods used to manage general corrosion, pitting corrosion, and MIC are also effective for crevice corrosion and biological fouling.

Based on its review, the staff finds this exception to the GALL report acceptable because the contaminants that cause general, pitting, and MIC can also cause crevice corrosion and biological fouling and the methods used to manage general corrosion, pitting corrosion, and MIC are also effective for crevice corrosion and biological fouling.

Exception 2. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 states in XI.M30 that the fuel oil aging management program is in part based on the fuel oil purity and testing requirements of the plant's Technical Specifications that are based on the Standard Technical Specifications of NUREG-1430 through NUREG-1433. TMI-1 has not adopted the Standard Technical Specifications as described in these NUREGs; however, the TMI-1 fuel oil specifications and procedures invoke equivalent requirements for fuel oil purity and fuel oil testing as described by the Standard Technical Specifications.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," and "monitoring and trending," program elements.

The staff noted that the applicant's definition of "equivalent requirements" as stated in this exception is not clear. In RAI B.2.1.16-1, dated September 29, 2008, the staff requested that the applicant provide additional information that included a direct comparison between the Standard TS and the plant fuel oil specifications along with a justification for any difference in fuel oil purity and testing parameters.

In its response to the RAI dated October 20, 2008, the applicant provided a comparison of the Standard Technical Specifications, Section 5.5.13 of NUREG-1430, with the plant fuel oil specifications. The staff noted that the plant fuel oil specifications meet requirements of NUREG-1430 for new fuel oil and stored fuel except for the frequency for determining total particulate concentration. As indicated by the applicant, the test frequency for total particulate concentration of 91 days is in accordance with GALL AMP XI.M30.

Based on its review, the staff finds the applicant's response to RAI B.2.1.16-1 acceptable because the plant fuel oil specifications meet the requirements of NUREG-1430 for new and stored fuel oil except for the frequency for determining total particulate concentration, which in this case is 91 days which is in accordance with GALL AMP XI.M30. The staff's concern described in RAI B.2.1.16-1 is resolved.

Based on its review, the staff finds that the exception is acceptable because the AMP meets the GALL Report recommendations for fuel oil quality parameters.

Exception 3. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 states that the program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and biological organisms. This is accomplished by analyzing multilevel samples for water and sediment, biological activity, and particulate on a periodic basis (at least quarterly). Fuel oil tanks should also be periodically drained of accumulated water and sediment, and, periodically drained, cleaned, and internally inspected. The following are exceptions to these requirements:

Multilevel sampling, tank bottom draining, cleaning, and internal inspection of the 7.3 gallon Station Blackout Diesel Clean Fuel Tank is not periodically performed at TMI-1. This tank is integral to the routine operation of the Station Blackout Diesel and collects excess clean fuel oil from the diesel engine that has been previously analyzed within its managed source tank, the Station Blackout Diesel Fuel Storage Tank. The Clean Fuel Tank is small in size and experiences a turnover of the fuel collected within as a result of routine engine operation. Therefore, the periodic draining of water and sediment from the bottom of the Clean Fuel Tank, and, the periodic draining, cleaning, and internal inspections are not necessary. To confirm the absence of any significant aging effects, a one-time inspection of the Station Blackout Diesel Clean Fuel Tank will be performed as part of the TMI-1 Fuel Oil Chemistry AMP. Should the one-time inspection reveal evidence of aging effects, this condition will be entered into the corrective action process for resolution.

Multilevel sampling, tank bottom draining, cleaning, and internal inspection of the 550 gallon Station Blackout Diesel Fuel Day Tank is not periodically performed at TMI-1. This tank is integral to the routine operation of the Station Blackout Diesel and is filled with fuel oil that has been previously analyzed within its managed source tank, the Station Blackout Diesel Fuel Storage Tank. The fuel oil within the Day Tank is recirculated to the Station Blackout Diesel Fuel Storage Tank quarterly to prevent the accumulation of contaminants and water and sediment. Therefore, the periodic draining of water and sediment from the bottom of the Day Tank, and, the periodic draining, cleaning, and internal inspections are not necessary. To confirm the absence of any significant aging effects, a one-time inspection of the Station Blackout Diesel Day Tank will be performed as part of the TMI-1 Fuel Oil Chemistry AMP. Should the one-time inspection reveal evidence of aging effects, this condition will be entered into the corrective action process for resolution.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program" program element.

The staff noted that it is not clear why these tanks can't be periodically drained, cleaned, and periodically inspected and the extent of UT examination of the tank bottoms. In RAI B.2.1.16-2, dated September 29, 2008, the staff requested that the applicant provide additional information concerning the design features and the extent of the UT inspection planned for the tank bottoms.

In its response to the RAI dated October 20, 2008, the applicant provided design details for the 550 gallon diesel fuel oil day tank and the 7.3 gallon diesel clean fuel oil tank. The applicant stated that design features, such as manholes or hatches do not exist in these tanks, and do not allow them to be readily inspected and cleaned or to allow multilevel sampling from these tanks. The applicant stated it will rely on a one-time volumetric examination of the exterior of the bottoms of these tanks to verify loss of material has not occurred in these tanks. The applicant stated that an internal visual inspection may be substituted in place of the volumetric inspection and if loss of material is detected by either external volumetric inspection or interior visual inspection, the finding will be entered into the corrective action process which will identify additional actions necessary to manage the degradation through the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.2.1.16-2 acceptable and also the exception to the GALL Report acceptable because 1) volumetric inspections of the exterior of the tank bottoms, or as an option, interior visual inspection of these tanks, will detect tank wall degradation prior to loss of the intended function of these tanks; and 2) actions will be identified and executed through the corrective action process to assure the intended function of the tanks will be maintained through the period of extended operation if degradation is found.

Exception 4. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 requires periodic multilevel sampling of tanks in accordance with the manual sampling standards of ASTM D 4057-95 (2000). TMI-1 has not committed to ASTM D 4057-95 (2000) for manual sampling standards:

The Diesel Fire Pump 350 gallon fuel oil storage tank and the Emergency Diesel Generator 550 gallon fuel oil day tank samples are single point samples obtained from the tank drain line located off of the bottom of the tank. This sample is not considered a multilevel sample as described in ASTM D 4057. Although the actual sample location is a single point taken from the tank bottom, the lower sample elevation is more likely to contain contaminants and water and sediment which tend to settle in the tank, thus making this a conservative and effective sampling location for fuel oil contaminants. Operating experience from January 2000 through June 2007 has shown that this sample method has yielded consistently acceptable sample results.

The 50,000 gallon fuel oil storage tank samples are obtained from an inline sample connection located off of the tank outlet piping. This sample is not considered a multilevel sample as described in ASTM D 4057. Sampling of the tank is performed after recirculating the tank contents which promotes tank mixing and purging of the recirculation and sample piping. Although the actual sample draw off location is off of the tank outlet which is towards the bottom of the tank, the lower sample elevation is more likely to contain contaminants and water and sediment which tend to settle in the tank, thus making this a conservative and effective sampling location for fuel oil contaminants. Operating experience from January 2005 through July 2007 has shown that this sample method has yielded consistently acceptable sample results.

By letter dated October 30, 2008, the applicant stated that this exception applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects,” and “acceptance criteria” program elements.

The staff noted that it is not clear why multilevel sampling of these tanks can’t be performed. In RAI B.2.1.16-3, dated September 29, 2008, the staff requested that the applicant provide additional information about the design features of these tanks.

In its response to the RAI dated October 20, 2008, the applicant stated that multilevel sampling in various tanks cannot be performed because there are no practical means to access the tanks to perform the sampling such as manways and drain lines.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.16-3 acceptable and also finds the exception to the GALL Report acceptable because 1) multilevel sampling is not practical and the samples are taken at the bottom of the tanks where contaminants tend to be the greatest, 2) a one-time inspection of these tanks, as described above, will confirm the absence of degradation of tank bottoms which would potentially be caused by water, sediment and particulate contamination, and 3) the finding will be entered into the corrective action process which will identify additional actions necessary to manage the degradation through the period of extended operation. The staff’s concern described in RAI B.2.1.16-3 is resolved.

Enhancements. The LRA states 12 enhancements to the GALL Report as follows:

> The TMI-1 Fuel Oil Chemistry AMP will be enhanced to include:
>
> - The completion of full spectrum fuel oil analysis within 31 days following the addition of new fuel oil into fuel storage tanks. (Enhancement No. 1)
> - The determination of water and sediment in accordance with ASTM D1796-97. (Enhancement No. 2)

- The analysis for particulate contamination in new and stored fuel oil in accordance with modified ASTM D2276, Method A. (Enhancement No. 3)

- The analysis for bacteria in new and stored fuel oil. (Enhancement No. 4)

- The addition of biocides, stabilizers, or corrosion inhibitors as determined by fuel oil analysis activities. (Enhancement No. 5)

- Activities to periodically drain, clean, and inspect the 50,000 gallon fuel oil storage tank, the 550 gallon diesel generator day tanks, the 25,000 gallon station blackout diesel fuel storage tank, and the Diesel Fire Pump 350 gallon fuel oil storage tanks. (Enhancement No. 6)

- Activities to periodically drain water and sediment from tank bottoms for the 50,000 gallon fuel oil storage tank, the 30,000 gallon diesel generator fuel storage tank, and the Diesel Fire Pump 350 gallon fuel oil storage tanks. (Enhancement No. 7)

- The analysis of new oil for specific or API gravity, kinematic viscosity, and water and sediment prior to filling the 50,000 gallon fuel oil storage tank and the Diesel Fire Pump 350 gallon fuel oil storage tanks. (Enhancement No. 8)

- Quarterly sampling for the 550 gallon diesel generator day tanks. (Enhancement No. 9)

- Sampling of new fuel oil deliveries in accordance with ASTM D 4057-95 (2000). (Enhancement No. 10)

- Multilevel sampling of the Emergency Diesel Generator 30,000 gallon fuel oil storage tank and the SBO Diesel Generator 25,000 gallon fuel oil storage tank in accordance with ASTM D 4057. (Enhancement No. 11)

- The use of ultrasonic techniques for determining tank bottom thicknesses should there be any evidence of loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling found during visual inspection activities. (Enhancement No. 12)

By letter dated October 30, 2008, the applicant stated that the enhancements apply to the program elements as follows:

- Enhancement No. 1 applies to the “scope of program” and “monitoring and trending” program elements.

- Enhancement No. 2 applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects” and “acceptance criteria” program elements.

- Enhancement No. 3 applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects” and “acceptance criteria” program elements.

- Enhancement No. 4 applies to the “monitoring and trending” program element.

- Enhancement No. 5 applies to the “preventive actions” and “corrective actions” program elements.

- Enhancement No. 6 applies to the “preventive actions” and “detection of aging effects” program elements.

- Enhancement No. 7 applies to the “preventive actions” program element.

- Enhancement No. 8 applies to the “scope of program” and “monitoring and trending” program elements.

- Enhancement No. 9 applies to the “parameters monitored/inspected,“ “detection of aging effects,” and “monitoring and trending” program elements.

- Enhancement No. 10 applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects,” and “acceptance criteria” program elements.

- Enhancement No. 11 applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects,” and “acceptance criteria” program elements.

- Enhancement No. 12 applies to the “detection of aging effects” program element.

The applicant committed to program enhancements that will a) add fuel oil sampling activities and increase sampling frequencies, b) provide for adherence to industry sampling standards, c) provide for biocide and inhibitor additions to fuel oil if required, d) provide for draining, cleaning and inspection of fuel tanks that had not previously been subjected to these activities, and e) use ultrasonic techniques to determine loss of material of tank bottoms should evidence of loss of material be identified during visual inspection activities.

Based on its review, the staff finds that these enhancements are acceptable because they provide changes to the applicant’s Fuel Oil Chemistry Program so that it will conform with GALL AMP XI.M30 and they will contribute to the additional assurance that loss of material will not progress such that the intended function of the piping and tanks subjected to the AMP will be compromised through the period of extended operation.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.16 and also interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

In the LRA the applicant stated that demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling are being adequately managed. The staff's review of documents provided by the applicant during the onsite audit did not include results of cleaning and visual inspection of fuel oil tanks. In RAI B.2.1.16-4, dated September 29, 2008, the staff requested additional information providing documentation of the fuel oil tank cleaning and visual inspections.

In its response to the RAI dated October 20, 2008, the applicant stated that only the FO-T-1 fuel oil tank was subjected to cleaning and internal visual inspection in September 2007. The applicant discovered unacceptable pitting corrosion. The pits, although small in diameter, were greater than 50% of the floor plate thickness, and were repaired in accordance with industry standard, American Petroleum Institute (API) 653 by welding patch plates over the affected areas. The applicant's AMP also provides for internal cleaning of the FO-T-1 fuel oil tank during the period of extended operation every ten years. The staff noted that all other fuel oil tanks will receive periodic cleaning and visual inspection of the tank interior or one-time external volumetric inspection of tank bottoms during the period of extended operation or prior to entering the period of extended operation. The staff finds that either volumetric inspection of exterior tank bottoms or cleaning or visual inspection of tank interiors detecting loss of material to be acceptable. Additionally, the applicant stated that indications of degradation will be entered into the corrective action process to identify actions to assure the intended function of the tanks will be maintained through the period of extended operation.

The staff noted that the documentation provided by the applicant during the onsite review supported the applicant's statements regarding operating experience and confirmed that the plant-specific operating experience did not reveal any degradation not bounded by industry experience except for the severe pitting corrosion (greater than 50% through-wall) in the FO-T-1 fuel oil tank. Acceptable corrective actions have been performed by the applicant for the severe pitting corrosion discovered in the FO-T-1 fuel oil tank.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.16, provides the applicant's UFSAR Supplement for the Fuel Oil Chemistry Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR after enhancements to the AMP are implemented.

In LRA Section A.5, Commitment No. 16, the applicant committed to implement Enhancements Nos. 1 through 12 prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Fuel Oil Chemistry Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Fuel Oil Chemistry Program and the applicant's response to the RAI's, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exceptions and their justifications and finds that the AMP, with exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff also reviewed the enhancements and confirmed that their implementation through Commitment No. 16, prior to the period of extended operation, would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 Reactor Vessel Surveillance

Summary of Technical Information in the Application. LRA Section B.2.1.17 describes the existing Reactor Vessel Surveillance Program as being consistent with GALL AMP XI.M31, "Reactor Vessel Surveillance."

TMI-1 participates in the Pressurized-Water Reactor Owners Group (PWROG) Master Integrated Reactor Vessel Surveillance Program (MIRVSP), to monitor the reactor vessel (RV) beltline materials that are projected to exceed a cumulative neutron fluence of 1×10^{17} n/cm^2 (E > 1.0 MeV) during 60 years of operation. The MIRVSP was initiated in 1977 with the seven operating B&W 177-fuel assembly plants. In 1988, six Westinghouse-designed plants having Babcock & Wilcox-fabricated RVs joined the MIRVSP. The integrated program is feasible because of the similarity of the design and the operating characteristics of the affected plants, as required by 10 CFR Part 50, Appendix H, paragraph II.C. The purpose of the MIRVSP is to augment the existing RV surveillance programs for the participating units, and to provide a basis for sharing information between plants. The MIRVSP provides sufficient material data to meet the American Society for Testing and Materials (ASTM) Standard E 185-82 capsule requirement for monitoring RV embrittlement.

The MIRVSP consists of two parts. The first is a plant-specific program. TMI-1 capsules were moved to the Crystal River-3 reactor for irradiation because the original TMI-1 capsule holder tubes were damaged. The second part of the MIRVSP consists of special research capsules designed to provide fracture toughness data on Linde 80 weld metals, which are predicted to exhibit high sensitivity to irradiation damage. The MIRVSP capsule withdrawal schedule for limiting Linde 80 weld metal heats addresses neutron fluence exposures corresponding to 60 and 80 years of operation.

Appendix H to 10 CFR Part 50, "Reactor Vessel Material Surveillance Program Requirements," includes requirements to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region of light water nuclear power reactors which result from exposure of these materials to neutron irradiation and the thermal environment. Appendix H to 10 CFR Part 50 endorses American Society for Testing Materials (ASTM) Standard E 185, "Surveillance Tests for Nuclear Reactor Vessels." Appendix H states that "the design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of ASTM Standard E 185 that is current on the issue date of the ASME Code to which the reactor vessel was purchased. Later editions of ASTM Standard E 185 may be used, but including only those editions through 1982."

ASTM Standard E 185-82 covers procedures for monitoring the radiation-induced changes in the mechanical properties of ferritic materials in the beltline of light-water cooled nuclear power reactor vessels. These practices include guidelines for designing a minimum surveillance program, selecting materials, and evaluating test results.

Staff Evaluation. The staff reviewed the applicant's claim of consistency with the GALL Report. In LRA Section B.2.1.17, "Reactor Vessel Surveillance," the applicant described its AMP to manage aging in RV beltline materials. The staff reviewed the LRA for consistency with GALL AMP XI.M31, "Reactor Vessel Surveillance."

By letter dated June 11, 1991, the staff approved the basis for the MIRVSP concept (BAW-1543, Revision 3), concluding that the program met the criteria provided by Appendix H to 10 CFR Part 50. Revision 4 to BAW-1543, issued in February 1993, updated some of the MIRVSP units' withdrawal schedules.

Additional supplements to BAW-1543, Revision 4, were provided to update information, particularly regarding fluence values and withdrawal schedules. BAW-1543, Revision 4, Supplement 1 provided revised fluence values for some units and revised some withdrawal schedules to comply with the 1973 Edition of the ASTM Standard E 185, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels" (ASTM E 185-73). BAW-1543, Revision 4, Supplement 2, issued in June 1996, reflected revised fluence values and withdrawal schedules. BAW-1543, Revision 4, Supplement 3, issued in February 1999, deleted Rancho Seco, R.E. Ginna, and Zion, Units 1 and 2 from the MIRVSP. BAW-1543, Revision 4, Supplement 4, issued in April 2001, added a disposal plan for archived specimens, updated the status for various capsules, and incorporated current fluence levels. The staff approved the revised and updated information by letter dated July 31, 2001 (ML0121303741), concluding that the proposed revisions satisfied the ASTM E 185-82 standards for plants participating in the MIRVSP, with the exception of Turkey Point, Units 3 and 4. BAW-1543, Supplement 4, Revision 5, issued in December 2003, revised withdrawal schedules for various plants, including TMI-1. By letter dated May 16, 2005 (ML051400361), the staff reviewed BAW-1543, Revision 5, and concluded that the proposed withdrawal schedules complied with Appendix H to 10 CFR Part 50. BAW-1543, Supplement 4, Revision 6 was submitted in December 2005, with updated fluence values and surveillance capsule insertion and withdrawal schedules. By letter dated June 28, 2007 (ML071770640), the staff concluded that the revisions were acceptable and the proposed withdrawal schedules satisfy the ASTM Standard E 185-82 for most MIRVSP plants, including TMI-1.

The TMI-1 limiting material contained in Capsule TMI-2-LG2 was tested and satisfied the fifth capsule requirement of ASTM Standard E 185-82. By letter dated November 17, 2003 (ML033220292), the staff reviewed BAW-2439, "Babcock & Wilcox Owners Group Analysis of Capsule TMI2-LG2: Master Integrated Reactor Vessel Surveillance Program," and concluded that upper-shelf fracture toughness tests conducted on the welds demonstrated that RG 1.99, Revision 2 conservatively represented the data in justifying continued operation with the unit's Linde 80 weld material. Wetted surface fluence values projected for 52 effective full power year (EFPY) ranged from 1.77×10^{19} n/cm^2 to 1.971×10^{19} n/cm^2 (E > 1 MeV) for the TMI-1 beltline materials. Specimens from the TMI2-LG2 capsule received an average fast neutron fluence of 2.01×10^{19} n/cm^2 (E > 1 MeV). The fluence values from the most recent capsule withdrawn, Capsule TMI2-LG2, are very close to the projected 52 EFPY fluence values. All capsules were removed and tested to meet the test procedures and reporting requirements of ASTM Standard E 185-82. This meets the ASTM E 185-82 criterion which states that capsules may be removed when the capsule neutron fluence is between one and two times the limiting fluence calculated for the vessel at EOL. The staff review of upper-shelf energy (USE) and pressurized thermal shock (PTS) values in the limiting materials found that all were acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.17 to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant provided the following information related to operating experience:

(1) The integrated reactor vessel material surveillance program was designed when the surveillance capsule holder tubes in a number of B&W reactors were damaged and could not be repaired without a complex and expensive repair program and considerable radiation exposure to personnel. For these plants, including TMI-1, the original Reactor Vessel Surveillance Program could not provide sufficient material data and dosimetry to monitor embrittlement; therefore, the integrated program was developed. The purpose of the MIRSVP is to augment the existing Reactor Vessel Surveillance Programs for the participating units and to provide a basis for sharing information between plants. The integrated program is feasible because of the similarity of the design and operating characteristics of the affected plants, as required by 10 CFR Part 50, Appendix H, paragraph II.C. The integrated program provides sufficient material data to meet the ASTM E 185-82 capsule program requirement for monitoring embrittlement.

(2) The Nuclear Regulatory Commission (NRC) staff evaluated the basis for the integrated program concept, determined the MIRVSP to be acceptable, and approved TR BAW-1543 (NP), Revision 3, by letter dated June 11, 1991. This letter concluded that the program met the applicable criteria from 10 CFR Part 50, Appendix H, “Reactor Vessel Material Surveillance Program Requirements.”

(3) TR BAW-1543 (NP), Revision 4, issued in February 1993, updated some of the units’ withdrawal schedules. TR BAW-1543 (NP), Revision 4, Supplement 1 reflected revised fluence values for some units and revised some withdrawal schedules to comply with the 1973 Edition of American Society for Testing and Materials (ASTM) Standard E 185, “Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels” (ASTM E 185-73). It was anticipated that future updates to TR BAW-1543 (NP) would only involve changes to the Revision 4 Supplement. Supplement 2, issued in June 1996, reflected revised fluence values and the revised withdrawal schedules. Supplement 3, issued in February 1999, deleted Rancho Seco, R. E. Ginna, and Zion, Units 1 and 2, from the program. In addition, it updated the capsule status and the peak EOL fluences for several plants. Supplement 4, issued in May 2002, incorporated the disposal plan for stored capsules, updated the status for various capsules, and incorporated current fluence levels.

(4) Supplement 5 was issued in December 2003 because the previous supplement included a commitment regarding Capsules OC1-D and OC3-F; however, that commitment could not be met because these capsules could not be removed from Crystal River, Unit 3. The NRC staff approved the revised withdrawal schedules for Oconee, Units 1, 2, and 3, and Three Mile Island, Unit 1 (TMI-1), in Supplement 5-A in May 2005. The NRC staff found that each of these plants met the capsule withdrawal schedule requirements of the 1982 Edition of ASTM Standard E 185 (ASTM E 185-82), even though the original capsules were not going to be withdrawn and tested for Oconee, Units 2 and 3, and TMI-1, because there were other capsules within the MIRVSP that contained the same limiting material for the subject plants that would be withdrawn and tested and, therefore, would satisfy the requirements of ASTM Standard E 185-82.

(5) Supplement 6 was submitted in December 2005 to provide updates to fluence values and to the surveillance capsule insertion and withdrawal schedules. The NRC issued Draft Safety Evaluation Report for Supplement 6 in May 2007 for comment, and in it indicated that the revised capsule insertion and withdrawal schedules are acceptable. Therefore, the MIRVSP continues to meet the requirements of 10 CFR Part 50, Appendix H and the capsule withdrawal schedule requirements of ASTM E 185-82. The operating experience of the Reactor Vessel Surveillance Program did not show any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. Periodic self-assessments of the program are performed to identify the areas that need improvement to maintain the quality performance of the program.

The applicant stated that the operating experience of the Reactor Vessel Surveillance Program did not show any adverse trend in performance and that problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence.

Based on its review, the staff finds that the evaluation of operating experience for this AMP demonstrates that the proposed Reactor Vessel Surveillance Program is capable of managing the reduction of fracture toughness of the reactor vessel beltline materials due to neutron embrittlement.

The staff confirmed that the "Operating Experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.17 provides the applicant's UFSAR Supplement for the Reactor Vessel Surveillance Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms with to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 17, the applicant committed to implementation of the enhancements related to the cavity dosimetry exchange schedule. The program will also be enhanced to clarify that, if future plant operations exceed the limitations or bounds specified in Regulatory Position 1.3 of RG 1.99, Rev. 2, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified.

The staff finds that the applicant has provided an adequate summary description of the Reactor Vessel Surveillance Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Reactor Vessel Surveillance Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 One-Time Inspection

Summary of Technical Information in the Application. LRA Section B.2.1.18 describes the new One-Time Inspection Program as being consistent, with an exception, to GALL AMP XI.M32, "One-Time Inspection."

The applicant stated that the program will a) confirm the effectiveness of the Water Chemistry Program to mitigate the loss of material, cracking, and reduction of heat transfer aging effects for steel, stainless steel, copper alloy, nickel alloy, and aluminum alloy in treated water, steam, and reactor coolant environments; b) confirm the effectiveness of the Fuel Oil Chemistry Program to mitigate the loss of material aging effect for steel, stainless steel, and copper alloy in a fuel oil environment; c) confirm the effectiveness of the Lubricating Oil Analysis Program to mitigate the loss of material and the reduction of heat transfer aging effects for steel, stainless steel, copper alloy, and aluminum alloy in a lubricating oil environment; and d) confirm the loss of material aging effect is not significant for stainless steel and copper alloy in an air and gas – wetted environment. The applicant also stated that the program includes determination of sample size, identification of inspection locations, determination of examination techniques, and evaluation of the need for follow-up examinations. The applicant further stated that if evidence of an aging effects is revealed by a one-time inspection, engineering evaluation of the inspection results will identify appropriate corrective actions.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the applicant's basis document for the program, together with the inspection sample basis document, proposed implementing procedures, and other supporting documentation related to the program. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M32, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an exception.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 specifies in XI.M32 the 2001 ASME Section XI B&PV Code, including the 2002 and 2003 Addenda for Subsections IWB, IWC, and IWD. The TMI-1 ISI Program Plan for the third ten-year inspection interval effective from April 20, 2001 through April 19, 2011, approved per 10 CFR 50.55a, is based on the 1995 ASME Section XI B&PV Code, including 1996 addenda. The next 120-month inspection interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval.

In RAI B.2.1.18-1, dated October 7, 2008, the staff requested that the applicant provide additional information concerning the code edition referenced by the applicant that was previously approved under 10 CFR 50.55a for the ten-year interval. Additionally, the staff notified the applicant that the stated exception should not be identified as such because no exception is needed for requirements found in the 2001 edition, but not in the 1995 edition of the code. The staff requested that the applicant provide additional information to indicate agreement or to provide justification if the applicant disagreed with the staff's finding.

In its response to the RAI dated October 30, 2008, the applicant stated that a formal exception to the ASME code version listed in the GALL Report is not required since the code edition used for the program had been previously approved under 10 CFR 50.55a for the current ten-year ISI interval. The applicant revised LRA Section B.2.1.18 to delete the previously stated exception to the GALL Report.

Based on its review, the staff finds the applicant's response to RAI B.2.1.18-1 acceptable because the applicant agreed with the staff's finding that differences in ASME Code Section XI editions need not be identified as exceptions to the GALL Report and because the applicant deleted the exception from the LRA. The staff's concern described in RAI B.2.1.18-1 is resolved.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.18 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the One-Time Inspection Program applies to potential aging effects for which current operating experience does not indicate the need for an AMP. The applicant also stated that the examinations performed in the One-Time Inspection program are consistent with industry practice and that site-specific operating experience does exist related to the effectiveness of NDE techniques at identifying, confirming and quantifying aging effects. The applicant provided three examples of site-specific operating experience to demonstrate effectiveness of examination techniques used in the One-Time Inspection AMP.

(1) The applicant stated that in October 2004 ultrasonic testing (UT) of a pipe found wall thickness was below the nominal manufacturing tolerance of 87%. The applicant stated that an engineering review for operability concluded that the as-found wall thickness was greater than the minimum code requirement and that at the maximum predicted corrosion rate the pipe's wall thickness would continue to be above the minimum requirement for several refueling cycles. The applicant stated that future re-inspection was implemented to ensure that a conservative design margin was maintained prior to replacement of the pipe.

(2) The applicant stated that in November 2005, UT pipe thickness inspections found that a pipe's wall thickness had been reduced. The applicant stated that an engineering review for operability concluded that the as-found wall thickness provided a safety factor of 10 and adequate corrosion margin until the next refueling outage, at which time the thinned pipe was scheduled to be replaced.

(3) The applicant stated that in November 2001, an ISI visual examination (VT-1) found cracking on the high pressure injection/ makeup nozzle thermal sleeve. The applicant stated that an engineering review for operability concluded that the identified crack in the thermal sleeve was very unlikely to propagate and that code requirements would continue to be met through the next operating cycle, after which appropriate corrective actions were taken.

The staff noted that the examples provide confirmation that the applicant's inspection methodology is capable of detecting the aging effects of interest, and the applicant's process of performing operability evaluations of degraded conditions appears to be appropriate and to result in acceptable corrective actions being taken prior to loss of component intended function.
In addition to these examples, the staff reviewed the applicant's operating experience discussion provided in the applicant's license renewal program basis document binder for the One-Time Inspection Program. The staff also reviewed additional selected corrective ARs related to examination methodology used in the AMP and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

Based on its review, the staff finds (1) that the OE for this AMP demonstrates that the proposed One-Time Inspection Program is capable of achieving its objective of confirming effectiveness of the applicant's Water Chemistry program, Fuel Oil Chemistry program, and Lubricating Oil Analysis program, and of detecting loss of material in stainless steel or copper alloy exposed to an air and gas – wetted environment, and (2) that the applicant's past corrective actions are consistent with appropriate corrective actions being taken through implementation of this program.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.18 provides the applicant's UFSAR Supplement for the One-Time Inspection Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms with to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 18, the applicant committed to implementation of the One-Time Inspection Program for aging management of applicable components prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the One-Time Inspection Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's One-Time Inspection Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and the applicant's response to the RAI, and finds that no formal exception to the GALL Report was required, and also finds that the AMP is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 Buried Piping and Tanks Inspection

Summary of Technical Information in the Application. LRA Section B.2.1.20 describes the applicant's existing Buried Piping and Tanks Inspection Program as being consistent, with exceptions and enhancements, to GALL AMP XI.M34, "Buried Piping and Tanks Inspection."

The applicant stated that the program provides preventive measures to mitigate corrosion, and periodic inspection to manage the effects of corrosion on the pressure-retaining capacity of buried steel piping and tanks.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions and enhancements to determine whether the AMP, with the exceptions and enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M34, the staff determined that the program elements for which the applicant claimed consistency with the GALL Report, are consistent.

Exception 1. The LRA states an exception to the GALL Report as follows:

> NUREG-1801, Section XI.M34 Buried Piping and Tanks Inspection aging management program scope only includes buried steel piping and components. However TMI-1 also includes stainless steel in their buried piping program that will be managed as part of this aging management program.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "preventive actions," and "acceptance criteria" program elements.

The staff noted that there is no program in the GALL Report that provides for inspection of buried stainless steel pipe and that the GALL Report recommends a plant specific program to manage loss of material for stainless steel piping exposed to soil. The staff also noted that the inspection methods used for buried cast iron, carbon steel and concrete-coated steel are applicable to buried stainless steel piping as well. The staff noted that buried stainless steel piping is more resistant to pitting and crevice corrosion than carbon steels and other materials addressed in GALL AMP XI.M34 when exposed to soil and that a visual inspection of the buried stainless steel piping will detect unacceptable loss of material.

Based on its review, the staff finds this exception to the GALL Report is acceptable because opportunistic or focused inspections will detect unacceptable loss of material of buried stainless steel piping, piping elements, and piping components, through the period of extended operation.

Exception 2. The LRA states an exception to the GALL Report as follows:

> NUREG-1801, Section XI.M34 Buried Piping and Tanks Inspection aging management program relies on preventive measures such as coatings and wrappings. However portions of buried stainless steel piping may not be coated or wrapped. Inspections of buried piping that is not wrapped will inspect for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "preventive actions," and "acceptance criteria" program elements.

Based on its review, the staff finds this exception to the GALL Report acceptable because stainless steel pipes that are not wrapped or coated 1) are more resistant to general, pitting, crevice, and microbiologically-influenced corrosion in soil environments than carbon steel and cast iron pipes; and 2) will be subjected to the same inspection activities as buried carbon steel and cast iron piping and that these activities are capable of detecting the aging effect of loss of material for stainless steel piping.

Exception 3. The LRA states an exception to the GALL Report as follows:

> NUREG-1801, Section XI.M34 Buried Piping and Tanks Inspection aging management program recommends that opportunistic or focused inspections of the external surfaces of buried components be performed. Internal inspection and UT of the buried Diesel Generator Fuel Storage 30,000 Gallon Tank wall will be used in lieu of inspection of the external surface of this tank. This internal surface visual inspection and UT examination of the tank wall will provide an alternate means to monitor the tank's pressure retaining ability.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements.

The staff noted that an UT examination is an acceptable method for detecting wall thinning of fuel tanks as stated in GALL AMP XI.M30. The staff finds that interior UT examination is capable of detecting loss of material in buried fuel oil tanks based on the recommendations of the GALL Report. However, the staff noted that it is not clear as to the extent and scope of the UT examinations. The staff also noted that there is a potential for degradation of a buried tank over the entire surface of the tank and that measurements of tank thickness representative of the entire tank surface need to be performed to ensure that the tank will continue to perform its intended function. In RAI B.2.1.20-1, dated September 29, 2008, the staff requested that the applicant provide additional information relating to the extent and scope of the UT measurements of the buried Diesel Generator Fuel Storage 30,000 Gallon Tank.

In its response to the RAI dated October 20, 20008, the applicant stated that the diesel generator fuel storage 30,000 gallon tank will be internally inspected in accordance with the guidance for assessing tank wall thickness contained in API Standard 1631, "Interior Lining and Periodic Inspection of Underground Storage Tanks" where internal tank walls will be divided into 3 foot square sections and UT examination will be performed to measure tank thickness in the center of each 3 foot square section. The applicant further stated that if any of these UT result is less than 75% of the original wall thickness then additional UT measurements will be performed in that 3 foot square section; if the average value of these additional UT measurements is less than 75% of the original wall thickness, the applicant stated that a condition report will be initiated in accordance with plant administrative procedures. The staff finds that unacceptable loss of material will be detected using the UT examination methods of API Standard 1631. The staff reviewed API Standard 1631 and noted that Section 10.6.2 provides a requirement to install cathodic protection if UT examination determines wall thicknesses to be between 75% and 85% of the original wall thickness. The staff noted that wall thicknesses between 75% and 85% of the original wall thickness indicate active loss of material and measures should be implemented to mitigate corrosion.

In RAI B.2.1.20-3, dated January 5, 2009, the staff requested that the applicant provide additional information on whether cathodic protection will be provided if wall thicknesses between 75% and 85% of the original wall thickness are detected, and if not, what measures will be taken to mitigate corrosion.

In its response to the RAI dated January 12, 2009, the applicant stated that if the average measured tank thickness is between 75% and 85% of the original thickness, an evaluation will be performed to determine if the loss of wall thickness occurred from the outside surface of the tank and that if it is determined that the loss of wall thickness occurred on the external surface, then a cathodic protection system will be installed to mitigate corrosion.

Based on its review, the staff finds the applicant's responses to RAI B.2.1.20-1 and RAI B.2.1.20-3 acceptable and also finds the exception acceptable because corrosion on the external tank surface will be mitigated with cathodic protection before the minimum allowable tank thickness is exceeded and because unacceptable loss of wall thickness will be detected before loss of the tank intended function occurs. The staff's concerns described in RAIs B.2.1.20-1 and B.2.1.20-3 are resolved.

Enhancement 1. The LRA states an enhancement to the GALL Report as follows:

> The Buried Piping and Tanks Inspection aging management program will be enhanced to include at least one opportunistic or focused excavation and inspection of stainless steel piping and components prior to entering the period of extended operation. (Inspection activities of buried piping and components for cast iron, carbon steel, and concrete-coated carbon steel materials have occurred in the ten years prior to the beginning of the period of extended operation.) Upon entering the period of extended operation, a focused inspection of an example of each of the above materials shall be performed within ten years, unless an opportunistic inspection occurs within this ten-year period.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program," "parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements.

The staff noted that there is no program in the GALL Report that provides for inspection of buried stainless steel pipe and that the GALL Report recommends a plant specific program to manage loss of material for stainless steel piping exposed to soil. The staff also noted that the inspection methods used for buried cast iron, carbon steel and concrete-coated steel are applicable to buried stainless steel as well. The staff noted that buried stainless steel piping is more resistant to pitting and crevice corrosion than carbon steels and other materials addressed in GALL AMP XI.M34 when exposed to soil and visual inspection of buried stainless steel piping will detect unacceptable loss of material.

Based on its review, the staff finds this enhancement acceptable because opportunistic or focused excavations of buried stainless steel piping will provide additional assurance that loss of material will not progress such that the intended function of the piping will not be compromised through the period of extended operation.

Enhancement 2. The LRA states an enhancement to the GALL Report as follows:

> An internal inspection and UT of the buried Diesel Generator Fuel Storage 30,000 Gallon Tank wall will be used in lieu of inspection of the external surface of this tank. This inspection will be performed within the ten-year period prior to the period of extended operation, and within ten years of entering the period of extended operation.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program," "parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements.

The staff noted that this enhancement is similar to exception #2.

Based on its review, the staff finds this enhancement acceptable because UT examination of buried diesel generator fuel storage 30,000 gallon tank walls will detect any wall thinning due to general, pitting and crevice corrosion providing assurance that loss of material will not progress such that the intended function of the tank will be compromised through the period of extended operation.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.20 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the operating experience shows that the program is effective in managing corrosion of external surfaces of buried steel piping and tanks through objective evidence showing that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion are being adequately managed. The applicant further stated that examples of operating experience provide objective evidence that the Buried Piping and Tanks Inspection program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff noted that an opportunistic inspection was performed by the applicant on buried fire service piping and that this piping was found to be in good condition. The applicant also performed an excavation of a de-ice line between the turbine building and condensate storage tank "A" which revealed coating deterioration and corrosion of the carbon steel piping. The applicant took corrective actions and had the affected piping segments replaced. The applicant determined that the cause of the degradation was use of improper backfill material. As a result, the applicant excavated additional underground piping and found that the proper backfill was used in these areas. The staff noted that the documentation provided by the applicant during the onsite review supports the applicant's statements regarding operating experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.20 provides the applicant's UFSAR Supplement for the Buried Piping and Tanks Inspection Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR, after the enhancements are implemented.

In LRA Section A.5, Commitment No. 20 the applicant committed to credit the existing Buried Piping and Tanks Inspection Program. The applicant committed to implement the enhancements related to opportunistic or focused excavation and inspection of stainless steel piping and components, and internal inspection and UT of the buried diesel generator fuel storage 30,000 gallon tank wall prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Buried Piping and Tanks Inspection Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Buried Piping and Tanks Inspection Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exceptions and their justifications and finds that the AMP, with exceptions, is adequate to manage the aging effects for which it is credited. The staff also reviewed the enhancements and confirmed that their implementation through Commitment No. 20, prior to the period of extended operation, would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 External Surfaces Monitoring

Summary of Technical Information in the Application. LRA Section B.2.1.21 describes the new External Surfaces Monitoring Program as being consistent, with an exception, with GALL AMP XI.M36, “External Surfaces Monitoring.”

The applicant stated that the program is credited to manage loss of material, loss of strength and hardening for components fabricated of steel, aluminum alloy, asbestos cloth, copper alloy, elastomers and stainless steel. The applicant further stated that this program will utilize visual inspections performed during system walkdowns, which may be augmented by physical manipulation when appropriate, to detect the above mentioned aging effects. The applicant clarified that this AMP is not credited for aging management for loss of material due to boric acid or for inspections of buried piping and aboveground steel tanks. The applicant further clarified that this AMP is not credited for aging management of the internal surfaces of components.

Staff Evaluation. During its audit and review, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant’s program to those in GALL AMP XI.M36, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an exception.

Exception. The LRA states an exception to the GALL Report as follows:

> The NUREG-1801 aging management program XI.M36, External Surfaces Monitoring program is based on system inspections and walkdowns. This program consists of periodic visual inspections of steel components such as piping, piping components, ducting, and other components within the scope of license renewal and subject to AMR in order to manage aging effects. The program manages aging effects through visual inspection of external surfaces for evidence of material loss. Exceptions to NUREG-1801 are:

- An increase to the scope of the materials inspected (i.e., aluminum alloy, asbestos cloth, copper alloy, elastomers, and stainless steel).

- An increase to the scope of aging effects (i.e., hardening and loss of strength).

By letter dated October 30, 2008, the applicant stated that this exception applies to the “scope of program” and “detection of aging effects” program elements.

GALL AMP XI.M36 states that this program is limited to the detection of loss of material due to general, pitting and crevice corrosion for components fabricated of steel only. In RAI B.2.1.21-1, dated September 29, 2008, the staff requested that the applicant provide additional information to justify the basis for expanding the scope of materials and aging effects beyond steel components and loss of material due to general, pitting and crevice corrosion as recommended by GALL AMP XI.M36. The staff also requested that the applicant describe the details of the specific inspection techniques that will be used in detecting all the aging effects for all the materials within the scope of the program and to provide justification on how the program will be capable of managing loss of material due to cracking for asbestos.

In part 1 of its response to the RAI dated October 20, 2008, the applicant stated that a visual inspection performed during system walkdowns will be capable of identifying loss of material for metallic components (aluminum alloy, copper alloy and stainless steel) other than steel. The applicant further stated that this visual inspection will monitor parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. The staff noted that metallic components, including copper alloy, aluminum alloy and stainless steel, would exhibit indications of loss of material on the surface similar to steel and a visual inspection will be capable of detecting age related degradation. The staff further noted that the these visual inspections will be performed by the applicant’s staff that are qualified to perform the activities of the visual inspection in accordance with site controlled procedures and processes.

Based on its review, the staff finds the applicant’s response to Part 1 of RAI B.2.1.21-1 acceptable, and also finds the related portion of the exception acceptable because (1) the applicant will be performing visual inspections that are capable of detecting loss of material in metallic components as they display indications of degradation similar to steel, for which GALL AMP XI.M36 was intended and (2) these visual inspections will be performed by the applicant’s staff that has been qualified in accordance with site controlled procedures and processes.

In part 2 of its response to the RAI, the applicant stated that it will supplement the visual inspection of elastomeric components with a resiliency test that will be performed by compressing the elastomeric components and then observing whether or not the material will return to its original shape. The applicant also stated the visual inspection performed during the system walkdown will look for indications of cracking and flaking of the elastomeric components. The staff noted that the resiliency test will supplement and aid the visual inspection in detecting age-related degradation because changes in material properties, such as hardening and loss of strength, can be detected during manipulation of elastomeric components by the relative inflexibility of the component, or by the failure of the component to return to its previous shape or configuration. Additionally, the applicant stated that corrective actions will be initiated if the inspection of these elastomeric components does not meet the acceptance criteria of this program, which is based on the component/material/environment combinations, design standards, industry codes and standards and engineering evaluation.

Based on its review, the staff finds the applicant's response to part 2 of RAI B.1.2.21-1 acceptable, and also finds the related portion of the exception acceptable because (1) the applicant will supplement the visual inspection for elastomeric components with a resiliency test to compress the material and then observe whether or not the component will return to its original shape which is capable of detecting age-related degradation for elastomeric components as described above; and (2) the applicant will initiate corrective actions prior to these components not being capable of performing their intended function.

In part 3 of its response to the RAI, the applicant stated that the program will manage loss of material due to cracking for asbestos cloth by periodic visual inspections performed during system walkdowns. The staff noted that the indications of loss of material for asbestos cloth include areas in which the material is cracked, missing or possibly flaking, so that a visual inspection would be capable of detecting age-related degradation associated with loss of material for asbestos cloth.

Based on its review, the staff finds the applicant's response to part 3 of RAI B.1.2.21-1 acceptable, and also finds the related portion of the exception acceptable because the applicant will be monitoring asbestos cloth for loss of material due to cracking with a periodic visual inspection that will inspect for missing or cracked areas in the expansion joints and initiate corrective actions based on this program's acceptance criteria, which is consistent with the corresponding "acceptance criteria" program element defined in GALL AMP XI.M36.

Based on its review, the staff finds the applicant's response to RAI B.2.1.21-1 acceptable and also finds all portions of the exception to the GALL Report acceptable. The staff's concerns described in RAI B.2.1.21-1 are resolved.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.21 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

During a system walkdown in December 2004, the applicant stated that it discovered an unpainted/uncoated Circulating Water System valve which should be painted to prevent external corrosion. The staff noted that the applicant initiated corrective actions upon this discovery and the valve was painted to prevent external corrosion. The staff further noted that during a February 2006 walkdown, the applicant noted minor corrosion on the surface on the condenser shell of the Control Building Chiller. The applicant initiated corrective actions. The areas in which corrosion was discovered were cleaned and then repainted in order to prevent any further degradation.

Based on this review, the staff finds (1) that the operating experience for this AMP demonstrates that the External Surfaces Monitoring program is achieving its objective of managing system components and (2) that the applicant is taking appropriate corrective actions through implementation of this program.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.21 provides the applicant's UFSAR Supplement for the External Surfaces Monitoring Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 21, the applicant committed to implementing the program prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the External Surfaces Monitoring Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and the associated justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also reviewed the response to the RAI and finds it acceptable. The staff concludes that the applicant has demonstrated that effects of 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 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

Summary of Technical Information in the Application. LRA Section B.2.1.22 describes the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as being consistent, with exceptions, with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."

The applicant stated that this program will be credited for managing the following aging effects: cracking due to stress corrosion cracking, hardening and loss of strength due to elastomer degradation, loss of material due to general, pitting, crevice and microbiologically-influenced corrosion, cracking and fouling, and reduction of heat transfer due to fouling. The applicant further states that visual inspections of the internal surfaces will be performed to monitor for these aging effects and volumetric testing and physical manipulation of components may supplement the visual inspection, as needed.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions to determine whether the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP XI.M38, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an exception. The staff identified an issue with the "operating experience" program element and requested that the applicant provide additional information. The staff noted that the applicant did not mention that for elastomeric materials a physical manipulation of those components would supplement the visual inspection. In RAI B.2.1.22-3, dated September 29, 2008, the staff requested that the applicant provide additional information on whether the program description in the LRA should mention that for elastomeric components a physical manipulation will supplement the visual inspection.

In its response to the RAI dated October 20, 2008, the applicant stated that a physical manipulation would supplement the periodic visual inspections as part of this AMP. The applicant amended LRA Sections A.2.1.22, B.2.1.22 (specifically the program description) and Commitment No. 22, to clearly identify that this AMP will be augmented by a physical manipulation of elastomeric components. The staff confirmed that the applicant amended the above mentioned LRA sections to include a clarification to augment the program with a physical manipulation. The staff noted that the applicant provided details of the physical manipulation in its response to RAI B.2.1.22-1, which is discussed later in this section.

Based on its review, the staff finds the applicant's response to RAI B.2.1.22-3 acceptable because the applicant amended the LRA, specifically the UFSAR Supplement and Commitment No. 22, to indicate that a physical manipulation of elastomeric components would supplement the periodic visual inspection performed as part of this AMP. The staff's concern described in RAI B.2.1.22-3 is resolved.

Exceptions. The LRA states 4 exceptions to the GALL Report as follows:

> The NUREG-1801 aging management program XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components consists of inspections of the internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other aging management programs. These internal inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. The program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. Exceptions to NUREG-1801 are:
>
> - An increase of the component material types within the scope of this program (i.e., asbestos, copper alloy with 15% zinc or more, copper alloy with less than 15% zinc, neoprene, nickel alloy, rubber, stainless steel, and titanium alloy) (Exception No. 1).
> - An increase of the aging effects within the scope of this program (i.e., cracking, reduction of heat transfer, and hardening and loss of strength) (Exception No. 2).
> - Volumetric testing will be used to detect SCC of stainless steel components (Exception No. 3).
> - Physical manipulation may be used to detect hardening and loss of strength of elastomers both internally and externally (Exception No. 4).

By letter dated October 30, 2008, the applicant stated that the exceptions apply to the program elements as follows:

- Exception No. 1 applies to the "scope of program" program element.
- Exception No. 2 applies to the "scope of program," "parameters monitored/inspected," "monitoring and trending" and "acceptance criteria" program elements.

- Exception No. 3 applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects” and “monitoring and trending” program elements.

- Exception No. 4 applies to the “scope of program,” “parameters monitored/inspected,“ “detection of aging effects” and “monitoring and trending” program elements.

The staff noted that the applicant’s exceptions are interconnected, such that the expansion in aging effects (i.e. cracking, reduction in heat transfer and hardening and loss of strength) are only applicable to certain materials that have been added to the scope of this AMP. The staff further noted that additional inspection techniques are only applicable to certain material and aging effect combinations. The staff has evaluated these exceptions such that the appropriate material, aging effect and inspection technique combination were taken into consideration.
GALL AMP XI.M38 states that this program is limited to the detection of visible evidence of corrosion to indicate possible loss of material for components fabricated of steel only with the use of a visual inspection. The staff determined that additional information was required from the applicant to provide justification for expanding of the scope of materials that this AMP will manage and to provide justification for expanding the scope of aging effects that this AMP will detect to include cracking, reduction of heat transfer, loss of strength and hardening. In RAI B.2.1.22-1, dated September 29, 2008, the staff requested that the applicant provide additional information to justify the basis for expanding the scope of materials and aging effects, as described above, beyond steel components and loss of material as recommended by GALL AMP XI.M38. The staff also asked the applicant to describe the details of the specific inspection techniques that will be used in detecting all the aging effects for all the materials within the scope of this AMP and to justify the inspection techniques’ ability to detect these aging effects during the period of extended operation.

In part 1 of its response to the RAI dated October 20, 2008, the applicant stated that a visual inspection that is performed during system and component surveillance and maintenance activities will be capable of identifying loss of material for metallic components (copper alloy, nickel alloy, stainless steel and titanium) other than steel. The applicant further stated that the visual inspection performed during inspections will monitor parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, pits and surface discontinuities. The staff noted that metallic components, including copper alloy, nickel alloy, stainless steel and titanium, would exhibit indications of loss of material on the surface similar to steel and a visual inspection will be capable of detecting age related degradation. The staff also noted that the these visual inspections will be performed by the applicant’s staff that are qualified to perform the activities of the visual inspection in accordance with site controlled procedures and processes. Regarding minimizing the potential for reduction of heat transfer capability, the applicant stated that the external surfaces of cooling coils will be inspected and cleaned for fouling at the same time that the internal surfaces of these components will be visually inspected as part of this program. The staff further noted that a visual inspection of the cooling coil surface will be capable of detecting any fouling (build up from whatever source) on the internal and external surface. The staff noted in the GALL AMP XI.M38 the “monitoring and trending” element states that results of the periodic inspections are monitored for indications of corrosion and fouling; and the “acceptance criteria” element states that indications of fouling that would impact component intended function are reported and will require further evaluation.

Based on its review, the staff finds part 1 of the applicant's response to RAI B.2.1.22-1 acceptable, and also finds the related exception acceptable because (1) the applicant will be performing visual inspections that are capable of detecting loss of material in metallic components as they display indications of corrosion similar to steel, for which GALL AMP XI.M38 was intended, (2) these visual inspections will be performed by the applicant's staff that has been qualified in accordance with site controlled procedures and processes, (3) this program requires visual inspections to detect fouling, which may lead to the aging effect of reduction in heat transfer, which is consistent with the recommendations GALL AMP XI.M38.

In part 2 of its response to the RAI, the applicant stated that it will supplement the visual inspection of elastomeric components with a resiliency test that will be performed by compressing the elastomeric components and then observing whether or not the material will return to its original shape. The applicant also stated the visual inspection performed during the system and component surveillance and maintenance activities will look for indications of cracking and flaking of the elastomeric components. The staff noted that the resiliency test will supplement and aid the visual inspection in detecting age-related degradation because changes in material properties, such as hardening and loss of strength, can be detected during manipulation of elastomeric components by the relative inflexibility of the component, or by the failure of the component to return to its previous shape or configuration.

The staff further noted that the applicant will initiate corrective actions if the inspection of these elastomer components does not meet the acceptance criteria of this program. The acceptance criteria are established in the maintenance and surveillance procedures or other established plant procedures so that indications of degradation that would impact component intended function are reported and will require further evaluation.

Based on its review, the staff finds part 2 of the applicant's response to RAI B.2.1.22-1 acceptable and also finds the related portion of the exception acceptable because (1) the applicant will supplement the visual inspection for elastomeric components with a resiliency test to compress the material and then observe whether or not the component will return to its original shape, which is capable of detecting age-related degradation for elastomeric components as described above, and (2) the applicant will initiate corrective actions prior to these components not being capable of performing their intended function.

In part 3 of its response to the RAI, the applicant stated that this AMP will manage loss of material due to cracking for asbestos cloth by periodic visual inspections performed during system and component surveillance and maintenance activities. The staff noted that the indications of loss of material for asbestos cloth include areas in which the material is cracked, missing or possibly flaking, so that a visual inspection would be capable of detecting age-related degradation associated with loss of material for asbestos cloth.

Based on its review, the staff finds part 3 of the applicant's response to RAI B.2.1.22-1 acceptable, and also finds the related portion of the exception acceptable because the applicant will be monitoring asbestos cloth for loss of material due to cracking with a periodic visual inspection that will inspect for missing or cracked areas in the expansion joints and initiate corrective actions based on this program's acceptance criteria, which is consistent with the corresponding "acceptance criteria" program element defined in GALL AMP XI.M38.

In part 4 of its response to the RAI, the applicant stated that the detection of any cracking from the ultrasonic testing that is performed on stainless steel components susceptible to stress corrosion cracking will be entered into the corrective actions process and will then be evaluated.

The staff further noted that the applicant's evaluation for the test or inspection results from the ultrasonic testing are performed when the acceptance criteria, defined as the detection of any cracking, is not met and a condition report is created to document the issue in accordance with plant procedures that meet the requirements of 10 CFR Part 50, Appendix B. Based on the staff's review of GALL AMP XI.M32 "One-Time Inspection," the staff noted that this GALL AMP recommends that the use of a volumetric inspection technique (either radiographic testing [RT] or ultrasonic testing [UT]) is adequate for detection of cracking due to stress corrosion cracking. The staff further noted the applicant's use of ultrasonic testing to detect cracking due to stress corrosion cracking is consistent with the recommendations given by the GALL Report.

Based on its review, the staff finds part 4 of the applicant's response to RAI B.2.1.22-1 acceptable, and also finds the related portion of the exception to be acceptable because (1) the applicant will initiate corrective actions upon the detection of any indication of cracking when inspecting components with the use of an ultrasonic inspection technique and (2) the applicant's use of an ultrasonic test to detect cracking due to stress corrosion cracking is consistent with the recommendations of the GALL AMP XI.M32.

Based on its review, the staff finds the applicant's response to RAI B.2.1.22-1 acceptable and also finds all portions of the exception to the GALL Report acceptable, as discussed above. The staff's concerns described in RAI B.2.1.22-1 are resolved.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.22 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff noted that the applicant found deposits on the fans and coolers of the Reactor Building Fans and Coolers during the refueling outage in 2003. The staff further noted that the boron deposits were cleaned and the reactor coolant leak that caused the deposits was corrected. The staff determined that additional information was needed regarding the applicant's subsequent inspections of the Reactor Building Fans and Coolers. In RAI B.2.1.22-2, dated September 29, 2008 the staff requested that the applicant provide additional information to describe the results of the internal inspections subsequent to the discovery of the boron deposits identified during the 2003 refueling outage. The staff also asked the applicant to clarify whether the existing procedures have been capable of managing age-related degradation in this system that would impact the components intended function.

In its response to the RAI dated October 20, 2008, the applicant stated that the inspections and cleaning of the Reactor Building air handling units are routinely performed during refueling outages, which occur at a 2-year frequency. The staff noted that the applicant performed external and internal evaluations and non-destructive examinations (NDE), whose results indicated that the corrosion that had occurred was within acceptable limits. The applicant stated that since the discovery of the boron deposits during the 2003 refueling outage, there have been two subsequent inspections which have identified negligible deposits of boron that have not resulted in significant degradation of the cooling coils or the air-handling units. The staff noted that the applicant is continuing to monitor and trend the inspection results to make certain that the loss of intended functions for these components will not occur.

Based on its review, the staff finds the applicant's response to RAI B.2.1.22-2 acceptable because (1) the applicant has routinely (2-year frequency) inspected these components and based on the applicant's evaluations and NDE results, degradation beyond acceptable limits has not occurred and (2) the applicant will continue to monitor and trend inspection results to ensure that corrective actions will be initiated prior to the loss of intended functions for these components. The staff's concern described in RAI B.2.1.22-2 is resolved.

Based on its review, the staff finds (1) that the operating experience for this AMP demonstrates that the AMP is achieving its objective of managing system components and (2) that the applicant is taking appropriate corrective actions through implementation of this program.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.22 provides the applicant's UFSAR Supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

The staff noted that LRA Section A.2.1.22 and LRA Section A.5, Commitment No. 22 did not state that for elastomeric materials a physical manipulation of those components would supplement the visual inspection. In RAI B.2.1.22-3, dated September 29, 2008, the staff requested that the applicant clarify whether or not Commitment No. 22 and LRA Section A.2.1.22 should mention that for elastomeric components a physical manipulation will supplement the visual inspection.

In its response to the RAI dated October 20, 2008, the applicant amended LRA Section A.2.1.22, B.2.1.22 and Commitment No. 22, to clearly identify that this AMP will be augmented by a physical manipulation for elastomeric components.

Based on its review, the staff finds the applicant's response to RAI B.2.1.22-3 acceptable because the applicant's amendment identifies that physical manipulation will be performed for elastomers. The staff's concern described in RAI B.2.1.22-3 is resolved.

In LRA Section A.5, Commitment No. 22, the applicant committed to augment this AMP with a physical manipulation for elastomeric components for detection of hardening and loss of strength.

The staff finds that the applicant has provided an adequate summary description of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and the associated justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff also reviewed the RAI responses and finds them acceptable. The staff concludes that the applicant has demonstrated that effects of 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 Lubricating Oil Analysis

Summary of Technical Information in the Application. LRA Section B.2.1.23 describes the applicant's existing Lubricating Oil Analysis Program as being consistent, with an exception, to GALL AMP XI.M39, "Lubricating Oil System."

The applicant stated that the program provides oil condition monitoring activities to manage the loss of material and the reduction of heat transfer in piping, piping components, piping elements, heat exchangers, and tanks within the scope of license renewal exposed to a lubricating oil environment. Sampling and condition monitoring activities identify specific wear products, contamination and the physical properties of lubricating oil within operating machinery to ensure that intended functions are maintained.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP XI.M39, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent, with an exception.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 recommends that flash point be determined for lubricating oil. Flash point will not be measured for all lubricating oil in service. The determination of flash point in lubricating oil is used to indicate the presence of highly volatile or flammable materials in a relatively nonvolatile or nonflammable material, such as found with fuel contamination in lubricating oil. The TMI-1 oil analysis guidelines only include the measurement of flash point for diesel engine lubricating oil where there is the potential for the contamination of lubricating oil with fuel. Flash point is not measured for other lubricating oils where there is no potential for the contamination of lubricating oil with fuel. For all lubricating oils, flash point is used as a quality control measurement when receiving new oil. Flash point is not a primary measurement to determine the presence of water or contaminants in lubricating oil, which are the environmental parameters necessary for the loss of material and reduction of heat transfer aging effects.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "parameters monitored/inspected" program element.

The staff confirmed that the Lubricating Oil Analysis Program provides for monitoring of the flash point for lubricating oil in diesel engine applications where the potential for dilution of lubricating oil is possible. The staff noted that monitoring the flash point of lubricating oil is a method that will determine the level of dilution of lubricating oil with fuel oil. As the flash point decreases, the dilution increases. The staff noted that it is not necessary to monitor flash point for non-diesel applications because the potential for lubricating oil dilution with fuel oil and the concomitant reduction of flash point is minimal.

Based on its review, the staff finds this exception to the GALL Report acceptable.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.23 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects/mechanisms are being adequately managed consistent with the CLB for the period of extended operation.

The staff noted that during routine review of oil sample data, the applicant discovered increased particle content in the main turbine oil reservoir and the Feedwater pump/turbine reservoir. The corrective action process indicated no bearing degradation. The source of the particulate was the bowser filter which was subsequently replaced. The staff noted that the documentation provided by the applicant during the onsite review supported the applicant's statements regarding operating experience and confirmed that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.23 provides the applicant's UFSAR Supplement for the Lubricating Oil Analysis Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 23, the applicant committed to the continued implementation of the existing Lubricating Oil Analysis Program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the Lubricating Oil Analysis Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Lubricating Oil Analysis Program, the staff finds 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 finds that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. 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 ASME Section XI, Subsection IWE

Summary of Technical Information in the Application. LRA Section B.2.1.24 describes the existing ASME Section XI, Subsection IWE Program as being consistent, with an exception with GALL AMP XI.S1 "ASME Section XI, Subsection IWE."

The applicant stated that the program provides for the inspection of the reactor building liner plate, including its integral attachments, penetration sleeves, pressure retaining bolting, personnel airlock and equipment hatch, seals, gaskets, and moisture barrier, and other pressure retaining components. The applicant state that section 10 CFR 50.55a specifies the use of the examination requirements in the ASME Code, Section XI, Subsection IWE, for steel liners of concrete containments and other containment components and that it has implemented the ASME Section XI, Subsection IWE, 1992 Edition including 1992 Addenda for current 10-year inspection interval, approved per 10 CFR 50.55a, for managing the aging effects of loss of material (general, pitting, and crevice corrosion), loss of pressure retaining bolting preload, cracking due to cyclic loading, loss of sealing, leakage through containment/deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants). The applicant further stated that it will adopt new ASME Code editions and addenda consistent with the provisions of 10 CFR 50.55a for the next 10-year inspection interval starting in 2011.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP XI.S1, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an exception. The staff identified an issue with the "operating experience" program element and requested that the application provide additional information.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 evaluation is based on ASME Section XI, 2001 Edition including 2002 and 2003 Addenda. The current TMI-1 ASME Section XI, Subsection IWE program plan for the First 10-Year Inspection Interval effective from September 9, 2001 through April 19, 2011, approved per 10 CFR 50.55a, is based on ASME Section XI, 1992 Edition including 1992 addenda. The next 10-Year Inspection Interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a 12 months before the start of the inspection interval.

The staff noted that the ASME code edition referenced by the applicant was previously approved under 10 CFR 50.55a for the ten-year interval. The use of the 1992 edition through the 1992 Addenda of the ASME code is consistent with the provisions in the 10 CFR 50.55a to use the code in effect 12 months prior to the start of the inspection interval. The staff has concluded that the stated exception should not be identified as such because no exception is needed for requirements found in the 2001 edition, but not in the 1992 edition of the code. In RAI B.2.1.24-1, dated October 7, 2008, the staff requested that the applicant provide additional information to indicate the applicant's agreement or provide justification if the applicant disagreed with the staff's determination.

In its response to the RAI dated October 30, 2008, the applicant agreed with the staff that a formal exception to the ASME code version listed in the GALL Report is not required since the code edition used for the program, had been previously approved under 10 CFR 50.55a for this ten-year interval. The applicant also amended LRA Section B.2.1.24 to delete the previously stated exception to the GALL Report. The applicant further made corresponding changes of related items in LRA Tables 3.2.1, 3.5.1 and Table 3.5.2.

Based on its review, the staff finds the applicant's response to RAI B.2.1.24-1 acceptable because the applicant agreed with the staff's determination that differences in ASME Code editions need not be identified as exceptions to the GALL Report, and because the applicant amended the LRA to delete the exception to the program. The staff's concern described in RAI B.2.1.24-1 is resolved.

The staff finds that the program includes all ASME Code, Section XI inspection requirements for the steel liner of the concrete containment (Class CC).

The staff finds the applicant's ASME Section XI, Subsection IWE program acceptable because it conforms to the recommendations of GALL AMP XI.S1, "ASME Section XI, Subsection IWE."

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.24 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff noted that the liner thickness corrosion rate was noticeable from operating experience provided, especially at locations adjacent to the moisture barrier at elevation 281' and 279'-6". To ensure the essential leak-tight condition of the containment for the period of extended operation, the staff identified an issue concerning the restoration of degraded plate areas where additional information was needed to complete its review.

In the LRA, the applicant committed to replacing the existing steam generators with new OTSGs prior to entering the period of extended operation. The applicant stated that the repair/replacement of the reactor building liner plate, removed for access purposes, will be performed in accordance with ASME Section XI, Subsection IWE. The applicant indicated that the liner will be restored (weld repair) to full design thickness at all locations identified as less than 90% before entering the period of extended operation. In RAI B.2.1.24-2, dated October 7, 2008, the staff requested that the applicant provide additional information to confirm the repairs and provide the proposed schedule for completion.

In its response to the RAI dated October 30, 2008, the applicant stated that prior to the period of extended operation, the reactor building liner will be restored to its nominal plate thickness by weld repair for the previously identified corroded areas where the thickness of the base metal is reduced by more than 10% of the nominal plate thickness. The applicant added this information to LRA Table A.5, as Commitment No. 42.

Based on its review, the staff finds the applicant's response to RAI B.2.1.24-2 acceptable because the applicant provided a Commitment for the completion of restoration of degraded plate areas of the reactor building liner plate. The staff's concern described in RAI B.2.1.24-2 is resolved.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.24 provides the applicant's UFSAR Supplement for the ASME Section XI, Subsection IWE Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 24, the applicant credited the existing program on an ongoing basis.

In LRA Section A.5, Commitment No. 42, the applicant committed to complete restoration of degraded plate areas of the reactor building liner plate operation prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the ASME Section XI, Subsection IWE Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI, Subsection IWE Program, the staff finds 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 finds that the exception did not need to be identified as such, and that the AMP is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 ASME Section XI, Subsection IWF

Summary of Technical Information in the Application. LRA Section B.2.1.26 describes the existing ASME Section XI, Subsection IWF program as being consistent, with an exception, with GALL AMP XI.S3 "ASME Section XI, Subsection IWF."

The applicant stated that the program is implemented through plant procedures, which provide for periodic visual inservice inspection of class 1, 2, and 3 component supports for loss of mechanical function and material and that section 50.55a of 10 CFR specifies the use of the examination requirements in the ASME Code, Section XI, Subsection IWF, for ASME Class 1, 2, 3, and MC piping and components and their associated supports. The applicant also stated that it has implemented ASME Section XI, Subsection IWF, 1995 Edition with the 1996 Addenda, for managing the aging effects of loss of mechanical function, loss of material, lock-up due wear, and loss of bolting function (which includes loss of material and loss of preload by inspecting for missing, detached, or loosened bolts). The applicant further stated that it will adopt new ASME Code editions and addenda consistent with the provisions of 10 CFR 50.55a for the next 10-year inspection interval starting in 2011.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP XI.S3, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an exception.

The staff finds that the applicant's ASME Section XI, Subsection IWF program includes all ASME Code, Section XI inspection requirements for Class 1, 2, 3, and MC piping and components and their associated supports.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 evaluation covers the 2001 edition including the 2002 and 2003 Addenda, as approved in 10 CFR 50.55a. The current TMI-1 ISI Program Plan for the Third Ten-Year Inspection Interval effective from April 20, 2001 through April 19, 2011, approved per 10 CFR 50.55a, is based on the 1995 ASME Section XI B&PV Code, including 1996 addenda. The next 120-month inspection interval for TMI-1 will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval.

The staff noted that the ASME code edition referenced by the applicant was previously approved under 10 CFR 50.55a for the ten-year interval. The use of the 1995 edition through the 1996 Addenda of the ASME code is consistent with the provisions in the 10 CFR 50.55a to use the Code in effect 12 months prior to the start of the inspection interval. The staff has concluded that the stated exception should not be identified as such because no exception is needed for requirements found in the 2001 edition, but not in the 1992 edition of the code. In RAI B.2.1.26-1, dated October 7, 2008, the staff requested that the applicant provide additional information to indicate agreement or to provide justification if the applicant disagreed with the staff's determination.

In its response to the RAI dated October 30, 2008, the applicant agreed with the staff that a formal exception to the ASME code version listed in the GALL Report, Revision 1 is not required since the code edition used for the program, ASME 1995 Edition including the 1996 addenda, had been previously approved under 10 CFR 50.55a for this ten-year interval. The applicant also amended LRA Section B.2.1.26 to delete the previously stated exception to the GALL Report. The applicant further made corresponding changes of related items in LRA Tables 3.5.1 and Table 3.5.2.

Based on its review, the staff finds the applicant's response to RAI B.2.1.26-1 acceptable because the applicant agreed with the staff's determination that differences in the specified ASME Code Section XI editions need not be identified as exceptions to the GALL Report, and because the applicant amended the LRA by deleting the previously stated exception to the ASME Section XI, Subsection IWF Program. The staff's concern described in RAI B.2.1.26-1 is resolved.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.26 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant explained that the operating experience of the ISI Program - IWF activities shows no adverse trend of program performance. The applicant stated that visual examinations conducted in 1999 identified that three class 2 supports were found unacceptable and required repair and that the unacceptable condition was related to loose or missing bolts or nuts. The applicant stated that as a result of the unacceptable conditions, the scope of inspection was expanded three times to include additional supports in order to determine the extent of such conditions. The applicant also stated that visual examinations conducted in 2001, 2003, and 2005 identified non-recordable indications that consisted of minor surface rust, loose bolts or nuts, and out of tolerance hot or cold settings for piping and component supports and that the loose bolts and nuts were tightened and the out of tolerance settings were restored to meet design requirements. The applicant further stated that the surface rust was evaluated and determined not to impact the structural integrity of the supports.

The staff finds assurance that the program is capturing degradation and correcting it in accordance with ASME Section XI and concludes that administrative controls are effective in detecting age-related degradation and initiating corrective action.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.26 provides the UFSAR Supplement for the ASME Section XI, Subsection IWF Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 26, the applicant credited the existing program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI, Subsection IWF Program the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and determined that it did not need to be identified as such, and that the AMP is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 concluded that the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.1.28 describes the existing Structures Monitoring Program as being consistent, with enhancements, to GALL AMP XI.S6, "Structures Monitoring Program."

The LRA states that the program will manage aging effects such that loss of material, cracking, change of material properties, and loss of form are detected by visual inspection with a frequency of every 5 years maximum, with provisions for more frequent inspections to ensure that there is no loss of structure or structural component intended function(s). The applicant also stated that the program consists of the Masonry Wall Program and RG 1.127, "Water Control Structures Inspection."

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements (Commitment No. 28) to determine whether the AMP, with the enhancements, is adequate to manage the aging effects for which it is credited in the LRA.

During its audit, the staff audited the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report. The staff interviewed the applicant's technical staff and reviewed the documents related to the Structures Monitoring Program, including the license renewal program evaluation report in which the applicant claimed the program elements are consistent with GALL AMP XI.S6.

Enhancements. LRA Section B.2.1.28 states an enhancement to:

- Include service building, UPS diesel building, mechanical draft cooling tower structures, miscellaneous yard structures (foundation for condensate storage tank, borated water storage tank, diesel fuel storage tank, altitude tank, duct banks, and manholes).

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "scope of program" program element.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the "scope of program" program element of the Structures Monitoring Program. The staff noted that the Structures Monitoring Program satisfies the monitoring requirements for plant structures that are within the scope of the NRC Maintenance Rule (10 CFR 50.65). TMI-1 structures and components that are within the scope of license renewal monitored by the Structures Monitoring Program include the following:

- Service Building
- UPS Diesel Building
- Intake Canal
- Mechanical Draft Cooling Tower Structures
- Miscellaneous Yard Structures (Foundation for condensate storage tank, borated water storage tank, diesel fuel storage tank, altitude tank, duct banks, and manholes);
- Inspection of submerged reinforced concrete for Intake Screen house and Pumphouse, Circulating Water Pump House, Mechanical Draft Cooling Tower Structures, Natural Draft Tower Basins. In the letter dated September 19, 2008, the applicant added the Circulating Water Tunnel
- Penetration Seals
- Cabinets, and Enclosures for Electrical Equipment and Components
- HVAC duct supports for loss of material

The staff found this enhancement acceptable because when the enhancement is implemented, TMI-1 AMP B.2.1.28, “Structures Monitoring Program,” will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

LRA Section B.2.1.28 includes additional enhancements to:

(1) Monitor penetration seals that perform flood barrier, shelter, protection, and pressure boundary intended functions.

(2) Monitor the intake canal for loss of material and loss of form.

(3) Monitor electrical panels, junction boxes, instrument panels, and conduits for loss of material due to corrosion.

(4) Monitor ground water chemistry by periodically sampling, testing, and analysis of ground water to confirm that the environment remains non-aggressive for buried reinforced concrete.

(5) Monitor reinforced concrete submerged in raw water associated with intake screen and pumphouse, circulating water pump house, mechanical draft cooling tower structures, natural draft cooling tower basins.

(6) Monitor vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF, for reduction or loss of isolation function.

(7) Parameters monitored will be enhanced to include plausible aging mechanisms.

(8) Monitor concrete structures for a reduction in anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking, and spalling.

By letter dated October 30, 2008, the applicant stated that these enhancements apply to the program elements as follows:

(1) Applies to the “scope of program," and "parameters monitored/inspected,” program elements.

(2) Applies to the “scope of program," "parameters monitored/inspected,” and “acceptance criteria” program elements.

(3) Applies to the “scope of program" program element.

(4) Applies to the “detection of aging effects” program element.

(5) Applies to the “scope of program," and "detection of aging effects” program elements.

(6) Applies to the "parameters monitored/inspected” program element.

(7) Applies to the "parameters monitored/inspected” program element.

(8) Applies to the "parameters monitored/inspected" program element.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the "parameters monitored or inspected" program element of the Structures Monitoring Program. The staff noted that the TMI-1 Structures Monitoring Program will be enhanced to include the following:

- Include reinforced concrete plausible aging mechanisms.
- Concrete structures will also be observed for a reduction in anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking, and spalling.
- Clarify that inspection be performed for loss of material due to corrosion (general, crevice, pitting) for steel components, such as embedment, panels and enclosures, doors, siding, metal deck, structural bolting, and anchors.
- Require inspection of penetration seals and structural seals, for degradations that will lead to a loss of seal by visual inspection of the seal for cracking, chipping, and hardening.
- Require monitoring of vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF, for reduction or loss of isolation function by inspecting the isolators for cracking and hardening.
- Intake Canal will be monitored for loss of material, loss of form/erosion, settlement, sedimentation, waves and currents.
- Periodic sampling, testing and analysis of ground water to confirm that the environment remains non-aggressive for buried reinforced concrete.

The staff also found that the program will be enhanced to require inspection of submerged structures in raw water on a frequency of 5 years. Inspection will be performed by a diver or by using remote video or other special safety equipment.

During its audit and review, in RAI B.2.1.28-1, dated October 7, 2008, the staff asked the applicant to provide the time frame of the "periodic" sampling and the results for the last two groundwater samplings. In its responses dated October 30, 2008, (ML083080376) the applicant stated that the groundwater sampling for pH, chloride, and sulfate concentrations will be performed every 5 years during the period of extended operation. The last two groundwater samplings include one sample taken in 2007 and three taken in 2005. The results are as follows:

Sample Date	6/19/2007	7/7/2005		
Location	MS-22	Well "A"	Well "B"	Well "C"
pH	7.4	7.8	7.8	7.7
Chloride (ppm)	58	57.3	42.4	65.5
Sulfates (ppm)	27	44.2	53.3	48.0

The staff found the above values meet the GALL Report limits (pH > 5.5; chloride < 500ppm; sulfate < 1500ppm) for non-aggressive ground water. The staff's concerns described in RAI B.2.1-

28-1 are resolved. The staff also finds this enhancement acceptable because when the enhancement is implemented, TMI-1 AMP B.2.1.28, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

LRA Section B.2.1.28 also includes an enhancement to:

- Revise acceptance criteria to provide details specified in ACI 349.3R-96.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "acceptance criteria" program element.

The staff reviewed the applicant's Structures Monitoring Program, and its AERMs under the "acceptance criteria" program element of the Structures Monitoring Program. The staff noted that the TMI-1 Structures Monitoring Program will be enhanced to include the following:

- Implementing procedures will be enhanced to detailed acceptance criteria specified in ACI 349.3R-96, Chapter 5.

- Implementing procedures will be enhanced to require that loss of material and loss of form for the Intake Canal be evaluated to ensure the required volume of emergency cooling water is in accordance with UFSAR Section 2.6.

The staff finds this enhancement acceptable because acceptance criteria are typically established such that corrective actions are initiated prior to loss of function and when the enhancement is implemented, TMI-1 AMP B.2.1.28, "Structures Monitoring Program," will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

<u>Operating Experience</u>. The staff reviewed the operating experience provided in LRA Section B.2.1.28 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that that silt accumulation was observed at the discharge of the 48-inch diameter emergency river water dump line and the silt covered approximately half the diameter of the pipe outlet, a condition also observed in 1999, during the baseline inspections. The applicant further stated that an engineering evaluation concluded that the discharge line remained capable of performing its intended function.

In RAI B.2.1.28-2, dated October 7, 2008, the staff requested that the applicant provide additional information to explain the conclusion reached in the engineering evaluation concerning silt in the emergency river water dump line.

In its response to the RAI dated October 30, 2008, the applicant stated that it assumed the 48" diameter pipe was reduced to a 24" diameter for the length containing silt. The applicant further stated that the resulting head loss due to the restricted flow was determined not to affect the required flow rate and, therefore, the intended function for the pipe remained unaffected. The applicant also stated that the analysis is conservative in that the 24” diameter assumed for the pipe length containing silt, results in ¼ of the area provided by the 48” diameter pipe being restricted, vs. having ½ of the 48” pipe diameter actually restricted by silt.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.28-2 acceptable because the applicant demonstrated that only ¼ of the area provided by the 48” pipe is required to conduct the flow. The staff’s concern described in RAI B.2.1.28-2 is resolved.

The staff conducted a field walk-down with the applicant’s technical staff to verify some existing conditions of the intake canal including the flood dike, riprap, crack on the masonry wall’s mortar joints at the 355 feet elevation of the turbine building’s airshaft, mechanical draft cooling tower, and the Unit – 2 fuel handling building. Overall, the staff found them in good condition and performing well. All of the observations are minor and acceptable in accordance with the applicant’s inspection procedures which are within the guidance of ACI 201.1R (Guide for Making a Condition Survey of Concrete in Service) and ACI 349-3R (Evaluation of Existing Nuclear Safety-Related Concrete Structures) as recommended in the GALL Report.

The staff finds that the applicant’s Structures Monitoring Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of aging on structures monitoring and the existing program operating experience revealed no degradation not bounded by industry experience.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.28 provides the UFSAR Supplement for the Structures Monitoring Program. The staff confirmed that the applicant’s UFSAR Supplement summary description for this program conforms to the staff’s recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 28, the applicant committed to implement the enhancements prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant’s Structures Monitoring Program, the staff finds 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 through Commitment No. 28 prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR Supplement for this AMP and concludes that the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.22 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

Summary of Technical Information in the Application. LRA Section B.2.1.31 describes the existing Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program as being consistent, with an enhancement, with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

The applicant stated that this program will provide reasonable assurance that the intended functions of electrical cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are used in instrumentation circuits with sensitive, high voltage, low-level signals exposed to adverse localized environments caused by heat, radiation or moisture, will be maintained consistent with the current licensing basis through the period of extended operation. The applicant also stated that calibration testing and system performance monitoring are currently being performed for in scope radiation monitoring circuits. The applicant further stated that direct cable testing will be performed as an enhancement to ensure that the cable and connection insulation resistance is adequate for the in scope nuclear instrumentation circuits to perform their intended functions.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.E2, the staff determined that the program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an enhancement. The staff identified an issue in the "scope of program" program element that required additional information.

In the "scope of program" program element, GALL AMP XI.E2 states this program applies to electrical cables and connections (cable system) used in circuits with sensitive, high voltage, low level signals such as radiation monitoring and nuclear instrumentation. The staff noted that the applicant excluded the incore monitoring system from the scope of the program. In RAI B.2.1.31-1, dated October 07, 2008, the staff requested that the applicant provide additional information as to why the incore monitoring system is not in scope of license renewal.

In its response to the RAI dated October 30, 2008, the applicant stated that the Incore Monitoring System circuits that are in scope for license renewal are included in the Environmental Qualification (EQ) of Electrical Components Program. The applicant also stated that because the Incore Monitoring System circuits that are in scope have their potential aging effects managed by the EQ of Electrical Components Program, these circuits are not included in the scope of this AMP.

Based on its review, the staff finds the applicant's response to RAI B.2.1.31-1 acceptable because the applicant has provided adequate basis to justify not including the incore monitoring system in the scope of this AMP. The staff's concern discussed in RAI B.2.1.31-1 is resolved.

Enhancement. The LRA states an enhancement to the GALL Report as follows:

> The TMI-1 Electrical Cables and Connections Not Subject to 10 CFR 50.59 Environmental Qualification Requirements Used In Instrumentation Circuits aging management program

is an existing program that will be enhanced. In scope radiation monitoring circuits are currently tested in alignment with NUREG-1801 aging management program XI.E2, Electrical Cables and Connections Not Subject to 10 CR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits. Existing testing practices will be enhanced by performing direct cable testing for in scope nuclear instrument circuits.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the “scope of program,” “parameters monitored/inspected,” “detection of aging effects,” and “acceptance criteria” program elements.

LRA Section B.2.1.31 states that the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, when enhanced, is consistent with GALL AMP XI.E2. The applicant also stated that the methods of testing are calibration testing and system performance monitoring which are being performed for in scope radiation monitoring circuits. The applicant also stated that direct cable testing will be performed once every 10 years as an enhancement to ensure cable and connection insulation resistance is adequate for in scope nuclear instrumentation circuits to perform their intended functions.

Based on its review, the staff finds the enhancement acceptable because it will make the applicant’s Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program consistent with GALL AMP XI.E2.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.31 and also interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that instrument circuit calibrations for the in-scope radiation monitoring circuits are part of surveillance testing and preventive maintenance that is currently being conducted. The staff did not identify any significant events attributed to insulation degradation nor is there a trend indicating age degradation. The applicant also stated that as an enhancement, the applicant will implement direct cable tests for the in-scope nuclear instrumentation circuits. This testing is to be added as an enhancement to existing practices, which include periodic electronic component calibration and heat balance computation. Recent operating experience with nuclear instrumentation circuits has resulted in a planned plant change for the replacement of the penetration for the Nuclear Instrument NI-12 source/wide range nuclear instrumentation to correct degraded penetration triaxial connectors. This issue is documented, evaluated and corrected via the corrective action program. The staff confirmed that the applicant had appropriately identified the appropriate root causes of cable aging and took appropriate corrective actions. The staff also reviewed the issue reports on these events in the license renewal basis binder. The staff determined that the issue reports demonstrated that the applicant had implemented appropriate corrective actions.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.31 provides the applicant's UFSAR Supplement for the Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 31, the applicant committed to implement the program enhancement prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, the staff finds all program elements for which the applicant claimed consistency with the GALL Report, are consistent with the implementation of an enhancement. The staff reviewed the enhancement and its justification and finds that the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that effects of 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 Metal Enclosed Bus

Summary of Technical Information in the Application. LRA Section B.2.1.33 describes the existing Metal Enclosed Bus Program as being consistent, with enhancement, to GALL AMP XI.E4, "Metal Enclosed Bus."

The applicant stated that the program will be managing the aging of metal enclosed buses. The applicant also states that a sample of accessible bolted connections will be checked for loose connections via thermography, which is an existing predictive maintenance activity. The applicant also stated that a sample of in scope metal enclosed bus internals is currently visually inspected and that this program, including its enhancements, will be implemented prior to the period of extended operation so that the intended functions of components within the scope of license renewal will be maintained during the period of extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.E4, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an enhancement.

Enhancement. The LRA states an enhancement to the GALL Report as follows:

> Thermography of metal enclosed busses is an existing TMI-1 predictive maintenance activity. A sample of in scope metal enclosed bus internals is currently visually inspected. These inspection activities will be enhanced to specify the following inspection criteria:
>
> - Internal portion of the metal enclosed bus will be visually inspected for cracks, corrosion, foreign debris, excessive dust build-up and evidence of moisture intrusion.
> - The bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation.
> - The internal bus supports will be visually inspected for structural integrity and signs of cracks.

As an additional enhancement, existing metal enclosed bus internal visual inspections will be expanded to include the 480V Metal Enclosed Bus and the Station Black Out Metal Enclosed Bus. This program, including its enhancements, will be implemented prior to the period of extended operation so that the intended functions of components within the scope of License Renewal will be maintained during the period of extended operation.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the “scope of program,” “parameters monitored/inspected,” “detection of aging effects,” and “corrective actions” program elements.

Based on its review, the staff finds the enhancement acceptable because it is consistent with GALL AMP XI.E4 and the AMP, with the enhancement ensures that the effects of aging will be adequately managed.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.33 and also interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that industry experience has shown failures have occurred on metal enclosed buses caused by cracked insulation and moisture or debris buildup internal to the metal enclosed bus. The applicant also stated that operating experience has also shown that bus connections in the metal enclosed bus exposed to appreciable ohmic heating during operation may experience loosening due to repeated cycling of connected loads. The applicant further stated that NRC Information Notice (IN) 2000-14, “Non Vital Bus Fault Leads to Fire and Loss of Offsite Power” and LER 324-06001, “Manual Scram Following a Loss of Startup Auxiliary Transformer” are examples of non-segregated bus duct failures. The applicant also stated that a specific review of the thermography results from preventive maintenance repetitive tasks and 1A Auxiliary Transformer bus duct internal inspections did not identify a trend related to aging degradation. A search of its corrective action database by the applicant has revealed no failures of metal closed buses.

Based on the review of the industry and applicant-identified operating experience, the staff has confirmed that the applicant has addressed operating experience related to this program, and has identified the applicable aging effects, i.e., loosening of bus connections, moisture or debris buildup internal to the metal enclosed bus, which are the aging effects identified in the GALL Report for this program.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.33 provides the applicant's UFSAR Supplement for the Metal Enclosed Bus Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 33, the applicant committed to the program enhancement relating to visual inspections prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Metal Enclosed Bus Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Metal Enclosed Bus Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the enhancement and its justification, and finds that with its implementation through Commitment No. 33 prior to the period of extended operation, the existing program will be consistent with the GALL AMP with which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the 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 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B.2.1.34 describes the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as being consistent, with an exception, with GALL AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The applicant stated that the program will be used to manage the aging effects of metallic parts of cable connections. The applicant stated that a representative sample of cable connections within the scope of license renewal will be selected for one-time testing prior to the period of extended operation to confirm that there is no age-related degradation of the electrical connection metallic parts. The applicant also stated that the scope of this sampling program will consider application (medium and low voltage), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc) and that the technical basis for the sample selection will be documented. The applicant further stated that the specific type of test performed will be a proven test for detecting loose connections, such as thermography or contact resistance measurement, as appropriate to the application.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP, with the exception, remained adequate to manage the aging effect for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.E6, the staff determined that the program elements for which the applicant claimed consistency with the GALL Report, are consistent, with an exception.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 describes an aging management program for electrical cable connections in Chapter XI: XI.E6 "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." An NRC and industry effort is in progress, working towards the issuance of a revision to XI.E6, via the Interim Staff Guidance (ISG) process. The latest draft revision of this ISG was presented for public comment in the September 6, 2007, Vol. 72, No. 172 issue of the Federal Register as: Proposed License Renewal Interim Staff Guidance LR-ISG-2007-02: Changes to Generic Aging Lessons Learned (GALL) Report Aging Management Program (AMP) XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" Solicitation of Public Comment. The exception for this aging management program is that the TMI-1 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is consistent with NUREG-1801 as it is modified by the September 6, 2007 draft revision of LR-ISG-2007-02.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "scope of program," "parameters monitored/inspected," "detection of aging effects," and "corrective actions" program elements.

The staff issued draft LR-ISG-2007-02 on September 6, 2007 for public comments. In this ISG, the staff clarifies and recommends a one-time inspection to ensure that either aging of metallic cable connections is not occurring or an existing maintenance program is effective. Upon receiving public comments, the staff will evaluate comments and make a determination to incorporate comments, as appropriate. Once the staff completes the LR-ISG, it will issue it for industry use. The staff will incorporate the approved LR-ISG into the next revision of the license renewal guidance document. Until then, the staff will compare the elements of applicant's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program against those currently in GALL AMP XI.E6. Any deviation from GALL AMP XI.E6 will require the applicant's identification for each exception and element affected. The staff noted that the applicant did not identify each specific exception or provide specific justification for each exception. Additionally, the applicant did not provide the program elements associated with each exception. In RAI B.2.1.34-1, the staff requested that the applicant provide additional information to describe each exception and provide the program elements associated with each exception.

In its response to the RAI dated October 30, 2008, the applicant stated that differences between the GALL XI.E6 AMP and the proposed revision via the September 2007 draft of LR-ISG-2007-

02, as relevant to Elements 1, 3, 4 and 7, include the following points of exception to the GALL XI.E6 AMP:

(1) This program includes external cable connections terminating at an active device. The program does not include wiring connections internal to an active assembly. This program does not include high voltage (>35 kV) switchyard connections. (AMP Element 1, Scope of Program).

(2) In-scope cable connections are evaluated for applicability of this program. The sample for the one-time inspection will be taken from cable connections, in scope for license renewal, that are not subject to 10 CFR 50.49 environmental qualification requirements. Factors considered in selection of the sample will include application (medium and low voltage), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.). (AMP Element 3, Parameters Monitored or Inspected).

(3) The TMI-1 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a one-time inspection, on a sampling basis. The intent of the one-time inspection is to confirm the absence of age-related degradation of cable connections (metallic parts). (Program Element 4, Detection of Aging Effects).

Based on its review, the staff finds the applicant’s response to RAI B.2.1.34-1 acceptable and also finds the exception to the “scope of program” program element acceptable because the exception is consistent with what is proposed in the final revision of LR-ISG-2007-02. The staff noted that the connections internal to an active assembly are considered part of the active assembly and do not require an AMR. The exclusion of high voltage connections (>35 kV) in the “scope of program” program element is acceptable because high voltage connections are addressed elsewhere in the SER under switchyard connections. The staff’s concern described in RAI B.2.1.34-1 is resolved.

Based on its review, the staff finds the exception to the “parameters monitored or inspected,” program element acceptable because the exception is consistent with the staff’s clarifications provided in LR-ISG-2007-02, because the sample of connections considered does not include the high-voltage application and low circuit loading and because the aging effect of loosening of cable connections due to thermal cycling is insignificant for low load circuits because of low current. The staff noted that high-voltage connections are addressed elsewhere in the SER under switchyard connections.

Based on its review, the staff finds the exception to the “detection of aging effects” program element acceptable. The staff noted that this is a one-time inspection on a sampling basis instead of periodic inspections as currently recommended in GALL AMP XI.E6. In reviewing operating experience to address industrial comments about GALL AMP XI.E6, the staff finds that few operating experiences related to failed connections are due to human errors or maintenance practices. The staff noted that the operating experience can’t support a periodic inspection as currently recommended in GALL AMP XI.E6. However, because there have been a limited number of age related failures of cable connections, a one-time inspection of the metallic portion of electrical cable connections is warranted. On this basis, the staff issued LR-ISG-2007-02 to provide clarification and recommend a one-time inspection, on a representative sampling basis, to

ensure that either aging of metallic cable connections is not occurring or existing preventive maintenance is effective, such that a periodic inspection is not needed.
The applicant amended the LRA to incorporate the exceptions as discussed above. The applicant also amended the LRA to include the following in the “discussion” column of Table 3.6.1:

Consistent with NUREG-1801 with exceptions. The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program, B.2.1.34, will be used to manage loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation of the metallic parts of cable connections.

The applicant also amended LRA Table 3.6.2-1, Electrical Commodities, Summary of Aging Management Evaluation, line item for Cable Connections (Metallic Parts) by changing the Notes column from "A" to "B."

Based on its review, the staff finds that the AMP, with the exceptions, is adequate to manage the aging effect for which it is credited.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.1.34 and also interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

In LRA Section B.2.1.34, the applicant stated that in April 2002, a phase terminal hot spot was discovered by an operator on rounds. The applicant stated that it appears the connection loosened due to heating and or vibration. After this event, the Exelon corporate Thermography Program Guide (MA-AA-716-230-1003) was implemented. The applicant also stated that in March of 2003, thermography revealed that a hot spot on a breaker load side connection existed. The “B” phase connection was 9^{o} C hotter than the “A” and “C” phase due to a slightly loose lug. The applicant further stated that in December of 2004, thermography revealed the line side connection was 11^{o} C hotter than the “A” and “B” phases as a result of a loosely crimped lug.

Based on the staff’s review of the applicant-identified operating experience, the staff has confirmed that the applicant has addressed operating experience related to this program, and has identified the applicable aging effects, i.e., loosening of cable connections, which is the aging effect identified by GALL for this program. The staff finds that this demonstrates that the existing maintenance program is effective to detect degraded connections and take appropriate corrective actions before component failures.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.1.34 provides the applicant’s UFSAR Supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff confirmed that the applicant’s UFSAR Supplement summary description for this program conforms to the staff’s recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 34, the applicant committed to implement the program prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirement Program, and the applicant's response to the RAI, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exceptions and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. 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).

3.0.3.2.25 Metal Fatigue of Reactor Coolant Pressure Boundary

Summary of Technical Information in the Application. LRA Section B.3.1.1 describes the existing Metal Fatigue of Reactor Coolant Pressure Boundary Program as being consistent, with an enhancement, to GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The applicant states that the program is credited for managing fatigue of reactor coolant pressure boundary components and other components. The AMP tracks the number of occurrences of significant thermal and pressure transients and compares the cumulative cycles to the number of design cycles. To assure staying within the pre-determined cycle limits, the applicant stated that the AMP enforces corrective actions if the cumulative cycle counts of any transient approaches either 80% of the design cycle limit, or 80% of the administrative cycle limit.

The applicant further stated environmental fatigue effects have been addressed by evaluating the sample components identified in NUREG/CR-6260 as being applicable to the plant. The applicant calculated the F_{en} values for each of the sample NUREG/CR-6260 components based on the methods shown in NUREG/CR-6583 and in NUREG/CR-5704 for carbon steel, low-alloy steel and stainless steel. Multiplying the F_{en} values by a factor of 1.5 and by the design CUF values of the corresponding components, the applicant obtained the Environmentally Adjusted Fatigue (EAF) usage factors. The staff noted that the applicant introduced the 1.5 factor in the calculations to account for the period of extended operation so that the final products are EAF-adjusted CUF values good for 60 years. Since these components would have fatigue usage that exceeds 1.0 if the transient cycle limits were increased to 1.5 times the current design limits, the program will maintain the current transient cycle design limits to manage fatigue during the period of extended operation.

Since for certain components the projected 60-year EAF-adjusted CUF values exceed the fatigue limit, the applicant performed additional fatigue evaluations for these components to establish a set of new transient cycle administrative limits which would result in acceptable EAF-adjusted CUF values during the period of the extended operation. The applicant stated that the new administrative cycle limits will be incorporated into the Metal Fatigue of Reactor Coolant Pressure Boundary Program prior to the period of the extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M1, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent, with an enhancement.

This AMP relies on transient cycle monitoring to evaluate the fatigue usage described in the LRA. The applicant stated that this approach tracks the number of occurrences of significant thermal and pressure transients (significant events) and compares the cumulative cycles, projected to cover the renewal period, against the number of design cycles specified in the design specifications. The applicant uses the projected cycles to evaluate the total cumulative usage factor for 60 years. The staff noted that for this approach to work, none of the significant events tracked should produce stresses greater than those that would be produced by the design transients, not just the number of cycles alone. Specifically, the staff notes, the P-T (Pressure and Temperature) characteristics, including their values, ranges, and rates, must all be bounded within those defined in the design specifications.

The staff determined that additional information was required to complete the review. In RAI B.3.1.1-1, dated September 29, 2008, the staff requested that the applicant provide additional information regarding its justification that the monitored transient data remains bounded by those defined in the design specification.

In its response to the RAI, dated October 20, 2008, the applicant stated that the plant fatigue monitoring procedure provides detailed design transient definitions that characterize each monitored design transient event. The applicant further stated the Control Room Operators review the monitored data during the logging of a transient in accordance with the plant fatigue monitoring procedures to confirm that the tracked events do not produce stresses greater than those produced by the design transients.

The applicant further stated that the fatigue monitoring procedure requires the Fatigue Monitoring Engineer to review the plant operating logs semi-annually and whenever an unusual reactor operating event occurs that would require abnormal coolant injections. The applicant also stated that plant logs and instrument data from the plant computer are used to assure that the actual transients have been appropriately characterized and are bounded by the design transients. If the plant process parameters (P, T and Flow rates) are not bounded by a design basis transient, as the applicant indicates, or if any tracked transient approaches 80% of its design cycle limit, the fatigue monitoring engineer is required to notify the Engineering Program Manager, initiate an engineering evaluation of the condition and determine the required corrective action.

Based on its review, the staff finds the applicant's response to RAI B.3.1.1-1 acceptable because the operational procedures that the applicant adopts for the transient events tracking are consistent with the GALL Report and conservative to ensure a valid cycle-based fatigue management program. The staff's concern described in RAI B.3.1.1-1 is resolved.

Enhancement. The LRA states an enhancement to the GALL Report as follows:

> The TMI-1 Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to add the statement: "Acceptable corrective actions include: reanalysis of the component to demonstrate that the design code limit will not be exceeded prior to or during the period

of extended operation; repair of the component; replacement of the component, or other methods approved by the NRC." In addition, the program will be enhanced to require a review of additional reactor coolant pressure boundary locations if the usage factor for one of the environmental fatigue sample locations approaches its design limit.

By letter dated October 30, 2008, the applicant stated that this enhancement applies to the "corrective actions" program element.

The staff determined that each of the corrective action items listed above has the potential to prevent the usage factor from exceeding the design code limit during the period of extended operation and the staff also confirmed that the applicant has incorporated the enhancements in LRA Section A.5, Commitment No. 37.

Based on its review, the staff finds this enhancement acceptable because the program will be consistent with GALL AMP XI.M1 and will provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.3.1.1 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant stated that the TMI-1 control room has maintained a transient cycle logbook which keeps the records of the transients that have occurred throughout the plants operating history. Additional data was recorded for facilitating characterization of transients if a more rigorous analysis should become necessary. The applicant indicates that no transient limits have been approached.

The applicant also has revised fatigue analyses to account for unanticipated thermal events that have been discovered in operating plants. The unanticipated thermal events include thermal stratification transients and thermal striping of piping in the reactor coolant system, identified by NRC IE Bulletin 88-08, and insurge/outsurge transients associated with operation of the pressurizer and pressurizer surge line, as identified by NRC IE Bulletin 88-11. These are thermal events that were not known to the nuclear industry before the issue dates of the Bulletins, and therefore, were not included in the original design analyses. Additionally, the applicant stated that due to modifications in the piping system, the High Pressure Injection (HPI) nozzle analyses were revised to account for a modification in the piping arrangement. The applicant stated that the modification results in revised numbers of cycles, which were incorporated into the monitoring program as revised limits.

The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.4.3, provides the applicant's UFSAR Supplement for the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 37, the applicant has committed to the enhancements of corrective actions and the review of additional reactor coolant pressure boundary locations prior to the period of extended operation.

The staff finds that the applicant has provided an adequate summary description of the Metal Fatigue of Reactor Coolant Pressure Boundary Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the enhancement and confirmed that its implementation prior to the period of extended operation through Commitment No. 37 would make the existing AMP consistent with the GALL AMP. The staff also reviewed the response to RAI B.3.1.1-1 and finds it acceptable. 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 determined that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.26 Concrete Containment Tendon Prestress

Summary of Technical Information in the Application. LRA Section B.3.1.2 describes the existing Concrete Containment Tendon Prestress Program as being consistent, with an exception, to GALL AMP X.S1, "Concrete Containment Tendon Prestress."

The applicant stated that the program is part of the ASME Section XI, Subsection IWL Program and is based on the 1992 Edition, with 1992 Addenda, of the ASME Section XI, Boiler and Pressure Vessel Code, and includes confirmatory actions that monitor loss of containment tendon prestressing forces during the current term and which will continue through the period of extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether the AMP with the exception is adequate to manage the aging effects for which the LRA credits it. In comparing the elements in the applicant's program to those in GALL AMP X.S1, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent, with an exception.

Exception. The LRA states an exception to the GALL Report as follows:

> NUREG-1801 evaluation specifies that acceptance criteria will normally consist of prescribed lower limit (PLL) and the minimum required value (MRV) calculated based on NRC Regulatory Guide 1.35.1 guidance. TMI-1 takes exception to using PLL as acceptance criteria. TMI-1 revised its program to comply with ASME Section XI, Subsection IWL, as mandated by 10 CFR 50.55a. Subsection IWL specifies that acceptance criteria be based on the actual design basis (or base value) forces and not the PLL or the base value forces less the upper bound losses. Therefore, IWL requires measured tendon force to be at least 95% of the base value rather than 95% of the significantly smaller PLL specified in Regulatory Guide 1.35. Thus TMI-1 acceptance criteria are more conservative than NUREG-1801 acceptance criteria.

By letter dated October 30, 2008, the applicant stated that this exception applies to the "acceptance criteria" program element.

The staff noted that GALL AMP X.S1 states that acceptance criteria will normally consist of predicted lower limit (PLL) and the minimum required prestressing force, also called minimum required value (MRV).

The staff noted that ASME Section XI, Subsection IWL requires measured tendon force to be at least 95% of the predicted force. The staff also noted that 95% of the PLL specified in Regulatory Guide 1.35.1 is less than 95% of the actual design basis forces.

Based on its review, the staff finds the exception to the GALL Report acceptable because the acceptance criteria established by the applicant are more conservative than the acceptance criteria recommended in the GALL Report.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.3.1.2 and also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The applicant explained the operating experience of the Concrete Containment Tendon Prestress Program activities. The staff reviewed historic inspection data from basis documents and noted that the most recent prestress tendon inspections were performed in 1999 and 2004. The staff noted that in 1999, forces were determined for 12 tendons (4 vertical, 5 hoop, 3 dome) during the 25^{th} year surveillance of the reactor building prestressing system and that the 12 tendons constitute a sample of approximately 2% of the total tendon population. The staff noted that the results of the tendon forces were above the 95% of the predicted force at the time of inspection.

The staff noted that in 2004, forces were determined for 12 tendons (4 vertical, 5 hoop, 3 dome) during the 30^{th} year surveillance of the reactor building prestressing system and that the 12 tendons constitute a sample of approximately 2% of the total tendon population. The staff noted that two tendons (V-137 & V-141) adjacent to tendon V-140 were added to the initial sample and subjected to testing because elongation of tendon V-140, measured during re-tensioning of tendons de-tensioned for removal of sample wires for testing, exceeded the acceptance limit. The staff noted that the elongation of tendon V-140 exceeded the 10% limit, a condition attributed to anchor head rotation observed during the re-tensioning process. And as a result, tendons V-137 and V-141 (like V-140, these tendons curve around the equipment opening) were added to the surveillance sample, de-tensioned, and re-tensioned. The staff noted that elongation of the two tendons met the 10% acceptance criterion and elongation of tendon V-140 also met the acceptance criterion during the second retensioning. The staff noted that the applicant's engineering evaluation concluded the initial excess elongation of tendon V-140 was acceptable per ASME IWL-3000. The staff agreed with the applicant's engineering evaluation since it followed the acceptance criteria of ASME IWL-3000.

Based on its review, the staff finds that the operating experience of the Concrete Containment Tendon Prestress Program did not show any adverse trend in performance and that any problems identified, would not cause significant impact to the safe operation of the plant. The staff also finds that adequate corrective actions were taken to prevent recurrence and that appropriate guidance for re-evaluation, repair, or replacement is provided if degradation is found. The staff noted that periodic self-assessments of the Concrete Containment Tendon Prestress Program are performed to identify the areas that need improvement to maintain the quality performance of the program. The staff concludes that administrative controls are effective in detecting age-related degradation and initiating corrective action.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A. 3.1.2 provides the UFSAR Supplement for the Concrete Containment Tendon Prestress Program. The staff confirmed that the applicant's UFSAR Supplement summary description for this program conforms to the staff's recommended UFSAR Supplement guidance found in the SRP-LR.

In LRA Section A.5, Commitment No. 38, the applicant credited the existing program on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the Concrete Containment Tendon Prestress Program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Concrete Containment Tendon Prestress Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exception and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. On the basis of its review, 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 determined that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified that the Nickel Alloy Aging Management Program is plant-specific. For the AMP that is not consistent with or not addressed by the GALL Report, the staff performed a complete review of the AMP to determine whether it was adequate to monitor or manage aging. The staff's review of this plant-specific AMP is documented in the following section of this SER.

3.0.3.3.1 Nickel Alloy Aging Management Program

Summary of Technical Information in the Application. LRA Section, Section B.2.2.1 describes the existing Nickel Alloy Aging Management Program as a plant specific program. The applicant states that the program manages cracking caused by primary water stress corrosion cracking (PWSCC) and that inspections, that include volumetric, surface and visual inspection techniques, are implemented through the augmented Inservice Inspection (ISI) program. The applicant further stated that the program provides for component evaluation, repair techniques, and scheduling of inspections in accordance with regulatory, industry, and ASME code requirements and commitments.

Staff Evaluation. The staff reviewed the Nickel Alloy Aging Management Program against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3 and Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 program elements.

The staff noted that revisions to 10 CFR 50.55a, “Codes and Standards” were issued in September of 2008 that change the requirements for inspection of nickel alloy welds. The applicant’s LRA does not address the new provisions of 10 CFR 50.55a because it was submitted in January 2008.

The staff discussed this issue with the applicant on January 15, 2009 who indicated that one of the changes affects this AMP and that the ISI program will be updated accordingly. The applicant indicated that changes have been incorporated into an interim revision of the ISI program and that its scheduling database has been updated to reflect the inspection requirements of ASME Code Case N-722. The applicant further indicated that the changes do not impact the text in the LRA describing the program and that the AMP implements the inspection of components through the augmented ISI program. The applicant indicated that there is no impact to any AMRs as a result of the revision to the regulation. The staff further discussed this issue with the applicant on June 29, 2009 who indicated that the ISI program and the corresponding basis document have been updated based on the revised requirements. Based on its review, the staff finds the applicant’s implementation of the provisions of 10 CR 50.55a and ASME Code Case N-722, acceptable.

The staff’s evaluation of the applicant’s program elements is discussed below:

Scope of the Program. The “scope of the program” program element in SRP-LR Section A.1.2.3.1 states that the specific program necessary for license renewal should be identified and that the scope of the program should include the specific structures and components of which the program manages the aging.

LRA Section B.2.2.1 states that the Nickel Alloy Aging Management Program manages cracking due to primary water stress corrosion cracking for nickel alloy components located in the Steam Generator, Reactor Vessel, Reactor Coolant, and Core Flooding system and that the components do not include steam generator tubes or secondary side components (included in the Steam Generator Tube Integrity Program), reactor vessel internals (included in the PWR Vessel Internals Program), or control rod drive mechanism nozzles (included in the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program).

The staff confirmed that specific systems/components that are subject to the Nickel Alloy Aging Management Program are identified in the LRA including components fabricated with alloy 600 and/or alloy 82/182 weld metal that are located in the Steam Generator, Reactor Vessel, Reactor Coolant, and Core Flooding system.

The staff confirmed that the “scope of the program” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

Preventive Actions. The “preventive actions” program element in SRP-LR Section A.1.2.3.2 states the following:

The activities for prevention and mitigation programs should be described. These actions should mitigate or prevent aging degradation.

For condition or performance monitoring programs, they do not rely on preventive actions and thus, this information need not be provided. More than one type of aging management program may be implemented to ensure that aging effects are managed.

LRA Section B.2.2.1 states that the Nickel Alloy Aging Management Program includes mitigation activities and strategies to ensure the long-term operability of nickel alloy components.

The applicant stated that some of the currently available mitigation techniques include weld overlay, replacement with Alloy 690/52/152 and half nozzle repair. The AMP lists recommended mitigation strategies that are available and considerations to include in a mitigation strategy. The staff confirmed that the Nickel Alloy Aging Management Program is an inspection and repair program that does provide for preventive actions to minimize PWSCC. However, the staff noted that mitigative techniques such as weld overlay repair or half nozzle repair techniques are employed when inspections detect cracking.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

Parameters Monitored/Inspected. The "parameters monitored or inspected" program element in SRP-LR Section A.1.2.3.3 states the following:

- The parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s).
- For a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects.
- For a performance monitoring program, a link should be established between the degradation of the particular structure or component intended function(s) and the parameter(s) being monitored.
- A performance monitoring program may not ensure the structure and component intended function(s) without linking the degradation of passive intended functions with the performance being monitored.
- For prevention and mitigation programs, the parameters monitored should be the specific parameters being controlled to achieve prevention or mitigation of aging effects.

LRA Section B.2.2.1 states that the Nickel Alloy Aging Management Program implements the inspection of components through an augmented In-service Inspection (ISI) program. This augmented program administers component evaluations, examination methods, scheduling, and site documentation to comply with regulatory and code requirements or industry commitments related to Nickel Alloy issues. The Nickel Alloy Aging Management Program uses a number of inspection techniques to detect cracking due to PWSCC including surface examinations, volumetric examinations, and bare metal visual examinations.

The staff noted that the parameters to be monitored/inspected that are linked to specific degradation (PWSCC) are identified in the Nickel Alloy Aging Management Program. Cracking is monitored through the augmented ISI program which uses various inspection methods to detect PWSCC depending on the component and long-term operability. Specifically, methods that monitor for cracking are visual bare metal inspection, surface inspection and volumetric inspection. Cracking, when discovered by inspection, is mitigated with weld overlay or half nozzle repair techniques. The staff also noted that volumetric, surface, and visual inspections are performed on a periodic basis such that degradation is monitored, but also noted that the Nickel Alloy Aging Management Program is focused on inspection for cracking and repair of any unacceptable cracking.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

Detection of Aging Effects. The "detection of aging effects" program element in SRP-LR Section A.1.2.3.4 states the following:

- Detection of aging effects should occur before there is a loss of the structure and component intended function(s). The parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended function(s) will be adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects. Provide information that links the parameters to be monitored or inspected to the aging effects being managed.

- Nuclear power plants are licensed based on redundancy, diversity, and defense-in-depth principles. A degraded or failed component reduces the reliability of the system, challenges safety systems, and contributes to plant risk. Thus, the effects of aging on a structure or component should be managed to ensure its availability to perform its intended function(s) as designed when called upon. In this way, all system level intended function(s), including redundancy, diversity, and defense-in-depth consistent with the plant's CLB, would be maintained for license renewal. A program based solely on detecting structure and component failure should not be considered as an effective aging management program for license renewal.

- This program element describes "when," "where," and "how" program data are collected (i.e., all aspects of activities to collect data as part of the program).

- The method or technique and frequency may be linked to plant-specific or industry-wide operating experience. Provide justification, including codes and standards referenced, that the technique and frequency are adequate to detect the aging effects before a loss of SC intended function. A program based solely on detecting SC failures is not considered an effective aging management program.

- When sampling is used to inspect a group of SCs, provide the basis for the inspection population and sample size. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects. The sample size should be based on such aspects of the SCs as the specific aging effect, location, existing technical information, system and structure design, materials of construction, service environment, or previous failure history. The samples should be biased toward locations most susceptible to the specific aging effect of concern in the period of extended operation. Provisions should also be included on expanding the sample size when degradation is detected in the initial sample.

LRA Section B.2.2.1 states that the Nickel Alloy Aging Management Program uses a number of inspection techniques to detect cracking due to PWSCC including surface examinations, volumetric examinations and bare metal visual examinations. The staff notes that the applicant's Nickel Alloy Aging Management Program is based on the recommendations of NEI and the EPRI Materials Reliability Program (MRP) where components are ranked based on susceptibility in accordance with MRP guidelines. The staff noted that inspection population and sample size are in accordance with MRP guidelines.

The staff noted that inspection for PWSCC using appropriate methods for the specific components are performed on a periodic basis such that cracking will be detected before the intended function is compromised. Inspection using volumetric, surface, and visual techniques are performed and scheduled in accordance with the applicant's augmented ISI program. The frequency and technique used to detect PWSCC are established in accordance with ASME codes, regulatory requirements, and industry recommendations. The applicant states that inspections will be carried out through the end of the period of extended operation.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. The "monitoring and trending" program element in SRP-LR Section A.1.2.3.5 states the following:

- Monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. Plant specific and/or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency.
- This program element describes "how" the data collected are evaluated and may also include trending for a forward look. This includes an evaluation of the results against the acceptance criteria and a prediction regarding the rate of degradation in order to confirm that timing of the next scheduled inspection will occur before a loss of SC intended function. Although aging indicators may be quantitative or qualitative, aging indicators should be quantified, to the extent possible, to allow trending. The parameter or indicator trended should be described. The methodology for analyzing the inspection or test results against the acceptance criteria should be described. Trending is a comparison of the current monitoring results with previous monitoring results in order to make predictions for the future.

The LRA states that inspection frequencies are in accordance with MRP guidelines and that contingencies for repairs are evaluated prior to each inspection outage. The applicant stated that monitoring of industry-operating experience is performed to incorporate any required changes to the Nickel Alloy Aging Management Program as a result of industry experience. The applicant further states that inspections are performed as part of an augmented ISI inspection plan where examination results are evaluated according to regulatory requirements and MRP guidance. The applicant states that initiation of an issue report to evaluate the examination results is required when the acceptance criteria is not met.

The staff noted that monitoring and trending in the applicant's Nickel Alloy Aging Management Program is performed in accordance with the augmented ISI program which cites ASME code requirements, EPRI MRP guidelines, and regulatory requirements.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

Acceptance Criteria. The "acceptance criteria" program element in SRP-LR Section A.1.2.3.6 states the following:

- The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation. The program should include a methodology for analyzing the results against applicable acceptance criteria.
- Acceptance criteria could be specific numerical values, or could consist of a discussion of the process for calculating specific numerical values of conditional acceptance criteria to ensure that the structure and component intended function(s) will be maintained under all CLB design conditions. Information from available references may be cited.
- It is not necessary to justify any acceptance criteria taken directly from the design basis information that is included in the UFSAR because that is a part of the CLB. Also, it is not necessary to discuss CLB design loads if the acceptance criteria do not permit degradation because a structure and component without degradation should continue to function as originally designed. Acceptance criteria, which do permit degradation, are based on maintaining the intended function under all CLB design loads.
- Qualitative inspections should be performed to same predetermined criteria as quantitative inspections by personnel in accordance with ASME Code and through approved site specific programs.

The LRA states that acceptance criteria are specified in the implementing procedures or work orders in accordance with the applicable regulatory or industry requirements and that any acceptance criteria not currently defined in the UFSAR will be defined by engineering and accepted based on procedures, regulatory requirements and accepted industry practices. The applicant states that all qualitative inspections will be performed to the same predetermined criteria as quantitative inspections in accordance with the ASME code and approved site procedures.

The staff noted that acceptance criteria of the Nickel Alloy Aging Management Program are based on ASME code and regulatory requirements and that ASME code methodology are used to analyze results of any cracking found during volumetric inspection, sizing of weld overlay repair, and the design of half nozzle repair. Additionally, the staff noted that qualitative visual inspections are performed by qualified personnel in accordance with the ASME code and implemented through the applicant's augmented ISI Program.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

Operating Experience. The "operating experience" program element in SRP-LR Section A.1.2.3.10 states the following:

- Operating experience with existing programs should be discussed. The operating experience of aging management programs, including past corrective actions resulting in program enhancements or additional programs, should be considered. A past failure would not necessarily invalidate an aging management program because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information can show where an existing program has succeeded and where it has failed (if at all) in intercepting aging degradation in a timely manner. This information should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the structure and component intended function(s) will be maintained during the period of extended operation.
- An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The staff reviewed the operating experience described in LRA Section B.2.2.1. The applicant stated that demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cracking due to PWSCC is being adequately managed. Operating experience provides objective evidence that the Nickel Alloy Aging Management Program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff audited the operating experience reports. The staff noted that the Nickel Alloy Aging Management Program provides the details of PWSCC at TMI-1 including past failures and program enhancements as a result of operating experience. The documents reviewed by the staff confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The operating experience provides evidence that PWSCC will be adequately managed through the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. LRA Section A.2.2.1 provides the applicant's UFSAR Supplement for the Nickel Alloy Aging Management Program. The staff confirmed that the UFSAR Supplement summary description for the Nickel Alloy Aging Management Program conforms to the staff's recommended UFSAR Supplement for this program as found in the SRP-LR.

In LRA Section A.5, Commitment No. 35, the applicant credited the existing program and committed to implement applicable Bulletins, Generic Letters, and staff-accepted industry guidelines on an ongoing basis.

The staff finds that the applicant has provided an adequate summary description of the Nickel Alloy Aging Management Program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Nickel Alloy Aging Management 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 during 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 the applicant has provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

3.0.4.1 Summary of Technical Information in Application

In Appendix A, "Final Safety Analysis Report Supplement," Section A.1.5, "Quality Assurance Programs and Administrative Controls," and Appendix B, "Aging Management Programs," Section B.1.3, "Quality Assurance Programs and Administrative Controls," of the LRA, the applicant described the "corrective action," "confirmation process," and, "administrative controls" program elements that are applied to the AMPs for both safety-related and nonsafety-related components. The applicant's quality assurance program (QAP) is used which includes the elements of corrective action, confirmation process, and administrative controls which are applied in accordance with the QAP regardless of the safety classification of the components. Section A.1.5 and Section B.1.3, of the LRA state that the QAP implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," and is consistent with the NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)."

3.0.4.2 Staff Evaluation

Pursuant to 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. The SRP-LR, Branch Technical Position RLSB-1, "Aging Management Review - Generic," describes ten attributes of an acceptable AMP. Three of these ten attributes are associated with the QA activities of corrective action, confirmation process, and administrative controls. Table A.1-1, "Elements of an Aging Management Program for License Renewal," of Branch Technical Position RLSB-1 provides the following description of these quality attributes:

- Attribute No. 7 - Corrective Actions, including root cause determination and prevention of recurrence, should be timely.
- Attribute No. 8 - Confirmation Process, which should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.
- Attribute No. 9 - Administrative Controls, which should provide a formal review and approval process.

The SRP-LR, Branch Technical Position IQMB-1, "Quality Assurance for Aging Management Programs," states that those aspects of an AMP that affect quality of safety-related structures, systems and components (SSCs) are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing 10 CFR Part 50, Appendix B, QAP may be used to address the elements of corrective action, confirmation process, and administrative control. Branch Technical Position IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The NRC staff reviewed the applicant's AMPs described in Appendix A and Appendix B of the LRA, and the associated implementing documents. The purpose of this review was to ensure that the QA attributes (corrective action, confirmation process, and administrative controls) were consistent with the staff's guidance described in Branch Technical Position IQMB-1.

Based on its review, the staff finds that the descriptions of the AMPs and their associated quality attributes provided in Appendix A, Section A.1.5, and Appendix B, Section B.1.3, of the LRA are consistent with the staff's position regarding QA for aging management.

3.0.4.3 Conclusion

On the basis of its review, the staff finds that the descriptions and applicability of the plant-specific AMPs and their associated quality attributes provided in Appendix A, Section A.1.5, and Appendix B, Section B.1.3 of the LRA, are consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (corrective action, confirmation process, and administrative control) of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.1 Aging Management of Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the RCS components and component groups of the following:

- Reactor Coolant System
- Reactor Vessel
- Reactor Vessel Internals
- Steam Generator

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor coolant system, reactor vessel, reactor vessel internal, and steam generator. LRA Table 3.1.1, "Summary of Aging Management Evaluations for the Reactor Vessel, Internals and Reactor Coolant System," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the reactor coolant system, reactor vessel, reactor vessel internals, and steam generator 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 issue 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 coolant system, reactor vessel, reactor vessel internals, and steam generator components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMPs to ensure the applicant's claim that certain AMPs were consistent with the GALL Report. The purpose of this audit was to examine the applicant's AMPs and related documentation and to verify the applicant's claim of consistency with the corresponding GALL Report AMPs. The staff did not repeat its review of the matters described in the GALL Report. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. The staff reviewed the AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Section 3.1.2.1 and 3.1.2.2.

The staff also reviewed the AMRs not consistent with or not addressed in the GALL Report. The review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Details of the staff's evaluation are discussed in SER Section 3.1.2.3.

For components which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.1-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.1 and addressed in the GALL Report.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel pressure vessel support skirt and attachment welds (3.1.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant (3.1.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.1)
Steel pump and valve closure bolting (3.1.1-4)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.1)
Stainless steel and nickel alloy reactor vessel internals components (3.1.1-5)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel Alloy tubes and sleeves in a reactor coolant and secondary feedwater/steam environment (3.1.1-6)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel and stainless steel reactor coolant pressure boundary closure bolting, head closure studs, support skirts and attachment welds, pressurizer relief tank components, steam generator components, piping and components external surfaces and bolting (3.1.1-7)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; and nickel-alloy reactor coolant pressure boundary piping, piping components, piping elements; flanges; nozzles and safe ends; pressurizer vessel shell heads and welds; heater sheaths and sleeves; penetrations; and thermal sleeves (3.1.1-8)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-9)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy steam generator components (flanges; penetrations; nozzles; safe ends, lower heads and welds) (3.1.1-10)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant (3.1.1-11)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.2)
Steel steam generator shell assembly exposed to secondary feedwater and steam (3.1.1-12)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry One-Time Inspection	Consistent with GALL Report (See SER Section 3.1.2.2.2)
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-13)	Loss of material due to general (steel only), pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.2)
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds (3.1.1-14)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.2)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See Section 3.1.2.2.2)
Steel steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam (3.1.1-16)	Loss of material due to general, pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry and, for Westinghouse Model 44 and 51 S/G, if general and pitting corrosion of the shell is known to exist, additional inspection procedures are to be developed.	Yes	Not applicable	Not applicable to TMI-1. (See SER Section 3.1.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds (3.1.1-17)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with 10 CFR 50, Appendix G, and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations.	Yes	TLAA	Loss of fracture toughness is a TLAA (See SER Section 3.1.2.2.3)
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles (3.1.1-18)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes	Reactor Vessel Surveillance	Consistent with GALL Report (See SER Section 3.1.2.2.3)
Stainless steel and nickel alloy top head enclosure vessel flange leak detection line (3.1.1-19)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4)
Stainless steel isolation condenser components exposed to reactor coolant (3.1.1-20)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4)
Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process (3.1.1-21)	Crack growth due to cyclic loading	TLAA	Yes	TLAA	Crack growth due to cyclic loading is a TLAA. (See SER Section 3.1.2.2.5)
Stainless steel and nickel alloy reactor vessel internals components exposed to reactor coolant and neutron flux (3.1.1-22)	Loss of fracture toughness due to neutron irradiation embrittlement, void swelling	UFSAR Supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	UFSAR Supplement Section A.5, Commitment Number 36	Consistent with GALL Report (See SER Section 3.1.2.2.6)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry Inservice Inspection, Subsections IWB, IWC, and IWD	Consistent with GALL Report (See SER Section 3.1.2.2.7)
Class 1 cast austenitic stainless steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-24)	Cracking due to stress corrosion cracking	Water Chemistry and, for CASS components that do not meet the NUREG-0313 guidelines, a plant specific AMP	Yes	Not applicable	Not applicable to TMI-1. (See SER Section 3.1.2.2.7)
Stainless steel jet pump sensing line (3.1.1-25)	Cracking due to cyclic loading	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.8)
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-26)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.8)
Stainless steel and nickel alloy reactor vessel internals screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	UFSAR Supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	UFSAR Supplement Section A.5, Commitment Number 36	Consistent with GALL Report (See SER Section 3.1.2.2.9)
Steel steam generator feedwater impingement plate and support exposed to secondary feedwater (3.1.1-28)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to TMI-1. (See SER Section 3.1.2.2.10)
Stainless steel steam dryers exposed to reactor coolant (3.1.1-29)	Cracking due to flow-induced vibration	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.11)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel reactor vessel internals components (e.g., Upper internals assembly, RCCA guide tube assemblies, Baffle/former assembly, Lower internal assembly, shroud assemblies, Plenum cover and plenum cylinder, Upper grid assembly, Control rod guide tube (CRGT) assembly, Core support shield assembly, Core barrel assembly, Lower grid assembly, Flow distributor assembly, Thermal shield, Instrumentation support structures) (3.1.1-30)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking	Water Chemistry and UFSAR Supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	Water Chemistry UFSAR Supplement Section A.5, Commitment Number 36	Consistent with GALL Report (See SER Section 3.1.2.2.12)
Nickel alloy and steel with nickel-alloy cladding piping, piping component, piping elements, penetrations, nozzles, safe ends, and welds (other than reactor vessel head); pressurizer heater sheaths, sleeves, diaphragm plate, manways and flanges; core support pads/core guide lugs (3.1.1-31)	Cracking due to primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and UFSAR Supplement commitment to implement applicable plant commitments to (1) NRC Orders, Bulletins, and Generic Letters associated with nickel alloys and (2) staff-accepted industry guidelines.	Yes	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry For nickel alloy, compliance with NRC Orders and UFSAR Supplement Section A.5, Commitment Number 35	Consistent with GALL Report (See SER Section 3.1.2.2.13)
Steel steam generator feedwater inlet ring and supports (3.1.1-32)	Wall thinning due to flow-accelerated corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Applies only to Recirculating Steam Generators. TMI-1 has Once-Through Steam Generators. (See SER Section 3.1.2.2.14)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel alloy reactor vessel internals components (3.1.1-33)	Changes in dimensions due to void swelling	UFSAR Supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	UFSAR Supplement Section A.5, Commitment Number 36	Consistent with GALL Report (See SER Section 3.1.2.2.15)
Stainless steel and nickel alloy reactor control rod drive head penetration pressure housings (3.1.1-34)	Cracking due to stress corrosion cracking and primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	Yes	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry For nickel alloy, compliance with NRC Orders and UFSAR Supplement Section A.5, Commitment Number 35	Consistent with GALL Report (See SER Section 3.1.2.2.16)
Steel with stainless steel or nickel alloy cladding primary side components; steam generator upper and lower heads, tubesheets and tube-to-tube sheet welds (3.1.1-35)	Cracking due to stress corrosion cracking and primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	Yes	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry For nickel alloy, compliance with NRC Orders and UFSAR Supplement, Section A.5, Commitment Number 35	Consistent with GALL Report (See SER Section 3.1.2.2.16)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy, stainless steel pressurizer spray head (3.1.1-36)	Cracking due to stress corrosion cracking and primary water stress corrosion cracking	Water Chemistry and One-Time Inspection and, for nickel alloy welded spray heads, comply with applicable NRC Orders and provide a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.2.16)
Stainless steel and nickel alloy reactor vessel internals components (e.g., Upper internals assembly, RCCA guide tube assemblies, Lower internal assembly, CEA shroud assemblies, Core shroud assembly, Core support shield assembly, Core barrel assembly, Lower grid assembly, Flow distributor assembly) (3.1.1-37)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Water Chemistry and UFSAR Supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	Water Chemistry UFSAR Supplement Section A.5, Commitment Number 36	Consistent with GALL Report (See SER Section 3.1.2.2.17)
Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant (3.1.1-38)	Cracking due to cyclic loading	BWR Control Rod Drive Return Line Nozzle	No	Not applicable	Not applicable to PWRs
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel alloy penetrations for control rod drive stub tubes instrumentation, jet pump instrumentation, standby liquid control, flux monitor, and drain line exposed to reactor coolant (3.1.1-40)	Cracking due to stress corrosion cracking, Intergranular stress corrosion cracking, cyclic loading	BWR Penetrations and Water Chemistry	No	Not applicable	Not applicable to PWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds (3.1.1-41)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-42)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel ID Attachment Welds and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant (3.1.1-43)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes (3.1.1-44)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-45)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs
Nickel alloy core shroud and core plate access hole cover (mechanical covers) (3.1.1-46)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant (3.1.1-47)	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-48)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Not applicable	Not applicable to PWRs
Nickel alloy core shroud and core plate access hole cover (welded covers) (3.1.1-49)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and, for BWRs with a crevice in the access hole covers, augmented inspection using UT or other demonstrated acceptable inspection of the access hole cover welds	No	Not applicable	Not applicable to PWRs
High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage (3.1.1-50)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	No	Not applicable	Not Applicable to PWRs
Cast austenitic stainless steel jet pump assembly castings; orificed fuel support (3.1.1-51)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Not applicable	Not applicable to PWRs
Steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems (3.1.1-52)	Cracking due to stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-53)	Loss of material due to general, pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-54)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (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) (3.1.1-55)	Loss of fracture toughness due to thermal aging embrittlement	Inservice Inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	Inservice Inspection, Subsections IWB, IWC, and IWD	Consistent with GALL Report
Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-56)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable.	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant > 250°C (> 482°F) (3.1.1-57)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Steel reactor coolant pressure boundary external surfaces exposed to air with borated water leakage (3.1.1-58)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam (3.1.1-59)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not Applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.2)
Stainless steel flux thimble tubes (with or without chrome plating) (3.1.1-60)	Loss of material due to wear	Flux Thimble Tube Inspection	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Stainless steel, steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F) (3.1.1-61)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	Inservice Inspection, Subsections IWB, IWC, and IWD	Consistent with GALL Report
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 (3.1.1-62)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	Inservice Inspection, Subsections IWB, IWC, and IWD	Consistent with GALL Report
Steel reactor vessel flange, stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant (e.g., upper and lower internals assembly, CEA shroud assembly, core support barrel, upper grid assembly, core support shield assembly, lower grid assembly) (3.1.1-63)	Loss of material due to wear	Inservice Inspection (IWB, IWC, and IWD)	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Stainless steel and steel with stainless steel or nickel alloy cladding pressurizer components (3.1.1-64)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy reactor vessel upper head and control rod drive penetration nozzles, instrument tubes, head vent pipe (top head), and welds (3.1.1-65)	Cracking due to primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	No	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	Consistent with GALL Report
Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam (3.1.1-66)	Loss of material due to erosion	Inservice Inspection (IWB, IWC, and IWD) for Class 2 components	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Steel with stainless steel or nickel alloy cladding; or stainless steel pressurizer components exposed to reactor coolant (3.1.1-67)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Stainless steel, steel with stainless steel cladding Class 1 piping, fittings, pump casings, valve bodies, nozzles, safe ends, manways, flanges, CRD housing; pressurizer heater sheaths, sleeves, diaphragm plate; pressurizer relief tank components, reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings (3.1.1-68)	Cracking due to stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry	Consistent with GALL Report
Stainless steel, nickel alloy safety injection nozzles, safe ends, and associated welds and buttering exposed to reactor coolant (3.1.1-69)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel; steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-70)	Cracking due to SCC, thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Inservice Inspection, Subsections IWB, IWC, and IWD Water Chemistry	Consistent with GALL Report (See SER Section 3.1.2.1.3)
High-strength low alloy steel closure head stud assembly exposed to air with reactor coolant leakage (3.1.1-71)	Cracking due to stress corrosion cracking; loss of material due to wear	Reactor Head Closure Studs	No	Reactor Head Closure Studs	Consistent with GALL Report
Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater/steam (3.1.1-72)	Cracking due to OD stress corrosion cracking and intergranular attack, loss of material due to fretting and wear	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Water Chemistry	Consistent with GALL Report
Nickel alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-73)	Cracking due to primary water stress corrosion cracking	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Water Chemistry	Consistent with GALL Report
Chrome plated steel, stainless steel, nickel alloy steam generator anti-vibration bars exposed to secondary feedwater/steam (3.1.1-74)	Cracking due to stress corrosion cracking, loss of material due to crevice corrosion and fretting	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Water Chemistry	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Nickel alloy once-through steam generator tubes exposed to secondary feedwater/steam (3.1.1-75)	Denting due to corrosion of carbon steel tube support plate	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Water Chemistry	Consistent with GALL Report
Steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/steam (3.1.1-76)	Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater/steam (3.1.1-77)	Loss of material due to wastage and pitting corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Steel steam generator tube support lattice bars exposed to secondary feedwater/steam (3.1.1-78)	Wall thinning due to flow-accelerated corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes exposed to secondary feedwater/steam (3.1.1-79)	Denting due to corrosion of steel tube support plate	Steam Generator Tube Integrity; Water Chemistry and, for plants that could experience denting at the upper support plates, evaluate potential for rapidly propagating cracks and then develop and take corrective actions consistent with NRC Bulletin 88-02.	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Cast austenitic stainless steel reactor vessel internals (e.g., upper internals assembly, lower internal assembly, CEA shroud assemblies, control rod guide tube assembly, core support shield assembly, lower grid assembly) (3.1.1-80)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	UFSAR Supplement Section A.5, Commitment Number 36	Consistent with GALL Report
Nickel alloy or nickel-alloy clad steam generator divider plate exposed to reactor coolant (3.1.1-81)	Cracking due to primary water stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor vessel internals and reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-83)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry	Consistent with GALL Report
Nickel alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater/steam (3.1.1-84)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection or Inservice Inspection (IWB, IWC, and IWD).	No	Water Chemistry One-Time Inspection, or Water Chemistry and Inservice Inspection, Subsections IWB, IWC, and IWD , or Water Chemistry and Steam Generator Tube Integrity	Consistent with GALL Report
Nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.1.1-85)	None	None	No	None	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (External); air with borated water leakage; concrete; gas (3.1.1-86)	None	None	No	None	Consistent with GALL Report
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.1.2.1.1)

The staff's review of the RCS component groups followed several approaches. One approach, documented in SER Section 3.1.2.1, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.1.2.2, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.1.2.3, discusses the staff's review of AMR results for components the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the RCS components is documented in SER Section 3.0.3.

3.1.2.1 AMR Results That Are 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 vessel internals, and reactor coolant system components:

- ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD
- Bolting Integrity Program
- Boric Acid Corrosion Program
- External Surfaces Monitoring
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- Nickel Alloy Aging Management Program
- Nickel Alloy Penetration nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors
- One-Time Inspection Program
- Reactor Head Closure Studs
- Reactor Vessel Surveillance
- Steam Generator Tube Integrity
- Time Limited Aging Analysis
- Water Chemistry Program

LRA Tables 3.1.2-1 through 3.1.2-4, summarize the results of AMRs for the reactor coolant system, reactor vessel, reactor vessel internal, and steam generator components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant had claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item describing how the information in the tables aligns with the information in the GALL Report. The staff reviewed those AMRs with Notes A through E, which indicate how the AMR was consistent with the GALL Report.

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

AMP. The staff reviewed these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff reviewed these line items to verify consistency with the GALL Report and 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note 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 reviewed these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff reviewed these line items to verify consistency with the GALL Report. The staff confirmed whether the AMR line item of the different component was applicable to the component under review and whether the exceptions to the GALL Report AMPs had been reviewed and accepted by the staff. 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 line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff reviewed these line items to verify 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 audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, it did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the reactor coolant system, reactor vessel, reactor vessel internals, and steam generator components that are subject to an AMR.

On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.1.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

3.1.2.1.1 AMR Results Identified as Not Applicable

Based on its initial review, the staff could not determine the specific reason why the applicant considered LRA Table 3.1.1, line items 53, 54, 56, 57, 59, 60, 63, 66, 67, 74, 76, 77 – 82, 85, and 87 to be not applicable. In RAI-AMR-GENERIC-1, dated October 16, 2008, the staff requested that the applicant provide additional information regarding these not applicable items so the staff could complete its evaluation.

In its response to the RAI dated November 12, 2008, the applicant stated that "Not Applicable" has been used when the component, material and environment combination does not exist in the identified GALL system grouping and also when the component, material and environment combination does exist but the LRA Table 3.x.1 item was not used because a different Table 3.x.1 item was selected to manage the identified aging effect/mechanism.

Based on its review, the staff finds the applicant's response to RAI-AMR-GENERIC-1 unacceptable because the applicant did not provide the specific reasons it used to consider the subject line items in LRA Table 3.1.1 not applicable and the staff could not complete its review.

In RAI-AMR-GENERIC-2, dated January 5, 2009, the staff requested that the applicant indicate for each of the LRA Table 3.x. 1 items where "not applicable" is listed in the "discussion" column, the specific reason why the item is considered not applicable to TMI-1. The staff also requested that if the component, material and environment does exist but the LRA Table 3.x.1 item was not used, that the applicant indicate what other 3.x.1 item was selected to manage the identified aging effect/mechanism.

In its response to the RAI dated January 12, 2009, the applicant provided a table identifying the specific reason(s) why a Table 3.x.1 item is not considered applicable to TMI-1.
Based on its review, the staff finds the applicant's response to RAI AMR-GENERIC-2 acceptable because the applicant provided the basis for LRA Table 3.x.1 line items identified as "not applicable." The staff's concern described in RAI AMR-GENERIC-2 is resolved.

LRA Table 3.1.1, line items 38 – 51, discusses the applicant's determination on GALL AMR line items that are applicable only to BWR-designed reactors. In the applicant AMR discussions for line items 38 – 51, no additional information is provided. The staff confirmed that AMR line items 38 – 51, in Table 1 of the GALL Report, Volume 1 are only applicable to BWR designed reactors, and that TMI-1 is a pressurized water reactor with a dry ambient containment. Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding AMR line items 38 – 51 in Table 1 of the GALL Report, Volume 1 are not applicable to TMI-1.

LRA Table 3.1.1, line items 74, 77 – 79, 81, and 82 discuss the applicant's determination on GALL AMR line items that are applicable only to recirculating steam generators. The staff confirmed that AMR line items 74, 77 – 79, 81, and 82, in Table 1 of the GALL Report, Volume 1 are only applicable to recirculating steam generators and confirmed by reviewing various sections of the LRA, that TMI-1 has once through steam generators. Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding AMR line items 74, 77 – 79, 81, and 82 in Table 1 of the GALL Report, Volume 1 are not applicable to TMI-1.

LRA Table 3.1.1, line item 53 addresses steel piping, piping components, and piping elements exposed to closed cycle cooling water. The GALL Report recommends the Closed-Cycle Cooling Water System AMP to manage loss of material due to general, pitting and crevice corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no steel piping, piping components, or piping elements exposed to closed cycle cooling water in the reactor vessel, internals and reactor coolant system. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that TMI-1 does not have support systems that are part of the reactor vessel, internals and reactor coolant system and steam generators within the scope of license renewal that contain the piping, piping components and piping elements fabricated from steel exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there are no steel piping, piping components, or piping elements exposed to closed cycle cooling water in the reactor vessel, internals and reactor coolant system and therefore, finds the applicant’s determination acceptable.

LRA Table 3.1.1, line item 54 addresses copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water. The GALL Report recommends the Closed-Cycle Cooling Water System AMP to manage loss of material due to pitting, crevice, and galvanic corrosion in this component group. In the applicant’s response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no copper alloy piping, piping components, or piping elements exposed to closed cycle cooling water in the reactor vessel, internals and reactor coolant system. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that TMI-1 does not have support systems that are part of the reactor vessel, internals and reactor coolant system and steam generators with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from copper alloy exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there are no steel piping, piping components, or piping elements exposed to closed cycle cooling water in the reactor vessel, internals and reactor coolant system and therefore, finds the applicant’s determination acceptable.

LRA Table 3.1.1, line item 56 addresses copper alloy greater than 15% zinc piping, piping components, and piping elements exposed to closed cycle cooling water. The GALL Report recommends the Selective Leaching of Materials AMP to manage loss of material due to selective leaching in this component group. In the applicant’s response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no copper alloy greater than 15% zinc piping, piping components, or piping elements exposed to closed cycle cooling water in the reactor vessel, internals and reactor coolant system. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that TMI-1 does not have support systems that are part of the reactor vessel, internals and reactor coolant system and steam generators with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from copper alloy greater than 15% zinc exposed to closed cycle cooling water.

Based on its review of the LRA, the staff confirmed that there are no copper alloy greater than 15% zinc piping, piping components, or piping elements exposed to closed cycle cooling water in the reactor vessel, internals and reactor coolant system and therefore, finds the applicant’s determination acceptable.

LRA Table 3.1.1, line item 57 addresses cast austenitic stainless steel class 1 piping, piping components, and piping elements and control rod drive pressure housings exposed to reactor coolant greater than 250^{o} C (greater than 482^{o} F). The GALL Report recommends the Thermal Aging Embrittlement of CASS AMP to manage loss of fracture toughness due to thermal aging embrittlement. In the applicant’s response to RAI-AMR-GENERIC-2, the applicant stated that with the exception of pump casings and valve bodies, there are no class 1 CASS piping, piping components, or piping elements in the reactor vessel, internals and reactor coolant system. The applicant also stated that the loss of fracture toughness due to thermal aging embrittlement in class 1 CASS pump casings and valve bodies is addressed by Item 3.1.1-55. Based on its review of the LRA, the staff confirmed that with the exception of pump casings and valve bodies, there are no class 1 CASS piping, piping components, or piping elements in the reactor vessel, internals and reactor coolant system. Also, based on its review of the LRA, the staff confirmed that loss of fracture toughness due to thermal aging embrittlement in class 1 CASS pump casings and valve bodies is addressed by Item 3.1.1-55. The staff finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 60 addresses stainless steel flux thimble tubes (with or without chrome plating). The GALL Report recommends the Flux Thimble Tube Inspection AMP to manage loss of material due to wear. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because it is applicable only to Westinghouse PWRs. Based on its review of the LRA and the GALL Report, the staff confirmed that this line item is only applicable to Westinghouse PWRs and also confirmed that TMI-1 is a Babcox and Wilcox PWR. The staff finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 63 addresses steel reactor vessel flange, stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant (e.g., upper and lower internals assembly, CEA shroud assembly, core support barrel, upper grid assembly, core support shield assembly, lower grid assembly). The GALL Report recommends the Inservice Inspection (IWB, IWC, and IWD) AMP to manage loss of material due to wear. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that based on TMI-1 and industry operating experience, the loss of material due to wear is not predicted for this component, material, and environment combination in the reactor vessel, internals and reactor coolant system. Based on its review of the LRA, and the TMI-1 and industry operating experience, the staff confirmed that for TMI-1, the loss of material due to wear is not predicted for this component, material, and environment combination in the reactor vessel, internals and reactor coolant system, and finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 66 addresses steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam. The GALL Report recommends the Inservice Inspection (IWB, IWC, and IWD) AMP for class 2 components to manage loss of material due to erosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there are no steel steam generator secondary manways and handhold covers exposed to air with leaking secondary-side water and/or steam in the reactor vessel, internals and reactor coolant system. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that TMI-1 does not have support systems that are part of the reactor vessel, internals and reactor coolant system and steam generators with-in the scope of license renewal that contain the steel steam generator secondary manways and handhold covers fabricated from steel exposed to air with leaking secondary-side water and/or steam. Based on its review of the LRA, the staff confirmed that that there are no steel steam generator secondary manways and handhold covers exposed to air with leaking secondary-side water and/or steam in the reactor vessel, internals and reactor coolant system, and finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 67 addresses steel with stainless steel or nickel alloy cladding; or stainless steel pressurizer components exposed to reactor coolant. The GALL Report recommends the Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry AMPs to manage cracking due to cyclic loading. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that cracking due to cyclic loading in stainless steel or steel with stainless steel cladding reactor vessel, internals and reactor coolant system piping and components exposed to reactor coolant is addressed by Item 3.1.1-62. The applicant also stated that item 3.1.1-67 identifies Water Chemistry as an additional aging management program; however, Water Chemistry is not an appropriate program for managing cracking due to cyclic loading. Based on its review of the LRA, the staff confirmed that cracking due to cyclic loading in stainless steel or steel with stainless steel cladding reactor vessel, internals and reactor coolant system piping and components exposed to reactor coolant is addressed by item 3.1.1-62, and also finds the applicant's Inservice Inspection Program adequate to manage cracking due to cyclic loading and therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 76 addresses steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/steam. The GALL Report recommends the Steam Generator Tube Integrity and Water Chemistry AMPs to manage loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there is no steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/steam in the reactor vessel, internals and reactor coolant system. The applicant also stated that the TMI-1 tube support plate is stainless steel. The applicant further stated that tube bundle wrappers are associated only with recirculating steam generators and that TMI-1 has once-through steam generators. Based on its review of the LRA, the staff confirmed that that TMI-1 has no steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/steam in the reactor vessel, internals and reactor coolant system and that the TMI-1 tube support plate is stainless steel. The staff also confirmed that tube bundle wrappers are associated only with recirculating steam generators and that TMI-1 has once-through steam generators. The staff finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 85 addresses nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external). The GALL Report indicates that there is no aging effect/mechanism and therefore, does not recommend an AMP. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there are no nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) in the reactor vessel, internals and reactor coolant system. The applicant stated that the external environment of nickel alloy piping, piping components, and piping elements in the reactor vessel, internals and reactor coolant system is air with borated water leakage. Based on its review of the LRA, the staff confirmed that there are no nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) in the reactor vessel, internals and reactor coolant system. The staff also confirmed that the external environment of nickel alloy piping, piping components, and piping elements in the reactor vessel, internals and reactor coolant system is air with borated water leakage. The staff finds the applicant's determination acceptable.

LRA Table 3.1.1, line item 87 addresses steel piping, piping components, and piping elements in concrete. The GALL Report indicates that there is no aging effect/mechanism and therefore, does not recommend an AMP. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there are no steel piping, piping components, and piping elements exposed to concrete in the reactor vessel, internals and reactor coolant system. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that TMI-1 does not have support systems that are part of the reactor vessel, internals and reactor coolant system and steam generators with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from steel exposed to concrete. Based on its review of the LRA, the staff confirmed that there are no steel piping, piping components, and piping elements exposed to concrete in the reactor vessel, internals and reactor coolant system. The staff finds the applicant's determination acceptable.

3.1.2.1.2 Wall Thinning due to Flow-Accelerated Corrosion

LRA Table 3.1.1, line item 3.1.1-59 addresses steel steam generator steam nozzle and safe ends; feedwater nozzle and safe ends; and auxiliary feedwater nozzles and safe ends exposed to secondary feedwater/steam. The GALL Report recommends the Flow Accelerated Corrosion AMP to manage wall thinning due to flow accelerated corrosion in this component group.

The LRA states that this line item is not applicable because this component, material, environment, and aging effect/mechanism combination does not apply to the reactor vessel, internals, and reactor coolant systems. The staff noted that the applicant does have steel steam nozzles and safe ends in a treated water environment in the steam generator system as identified on page 3.1-131 of the LRA in Table 3.1.2-4. In addition, the staff noted that, LRA Table 3.0-1, defines treated water, and includes wet steam applications which are referenced as steam or secondary feedwater/steam in the GALL Report.

In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why there are no aging effects requiring management for the component/material/environment combination identified above.

In its response to the RAI dated January 12, 2009, the applicant stated that the feedwater and emergency feedwater nozzles are nickel-alloy and are not susceptible to flow accelerated corrosion and do not have safe ends. The applicant also stated that the main steam nozzles are low alloy steel and the main steam safe ends are carbon steel, however, flow accelerated corrosion is not predicted for these locations in the steam generator that are exposed to main steam because the main steam system by design is 35 degrees superheated and is therefore well above the optimum range for flow accelerated corrosion.

Based on its review, the staff finds the response to the RAI acceptable because the feedwater and emergency feedwater nozzles are nickel-alloy, do not have safe ends, and are not susceptible to flow-accelerated corrosion. The staff reviewed EPRI guidelines NSAC-202L-R2, which is recommended in GALL AMP XI.M17, “Flow-Accelerated Corrosion,” and determined that superheated steam systems regardless of temperature and pressure have a very low susceptibility to flow-accelerated corrosion and may be excluded from the Flow Accelerated Corrosion Program. The staff noted that the carbon steel main steam safe end locations in the steam generator are exposed to superheated steam and will have a very low susceptibility to flow-accelerated corrosion. The staff’s concern described in RAI-AMR-Generic-2 for Item 3.1.1.59 is resolved.

3.1.2.1.3 Cracking due to Stress Corrosion Cracking (SCC), Thermal and Mechanical Loading

LRA Table 3.1.1, line item 3.1.1-70 addresses stainless steel and steel with stainless steel cladding class 1 piping, fittings and branch connections less than NPS 4 exposed to reactor coolant. The GALL report recommends the Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping AMPS to manage cracking due to stress corrosion cracking, thermal and mechanical loading in this component group.

The applicant credits the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, and the Water Chemistry Program to manage cracking due to stress corrosion cracking in the stainless steel class 1 piping, fittings, and branch connections less than NPS 4 exposed to reactor coolant and treated water.

The SRP-LR recommends implementation of the Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping Programs to manage cracking in small-bore piping. The applicant stated in the discussion column of Item 3.1.1-70, that since cracking has been discovered in small bore piping, the periodic examination activities of ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, are credited with aging management of class 1 small-bore piping in lieu of GALL AMP XI.M35, "One Time Inspection of ASME Code Class 1 Small-Bore Piping." In GALL AMP XI.M35 the "monitoring and trending" element recommends evaluation of inspection results to determine if additional examinations are needed and recommends that additional inspections should be performed at a sufficient number of locations to assure an adequate sample size. The staff noted that the LRA does not provide the details of methods used to detect cracking of small bore piping (including inspection and evaluation methods, inspection scope and frequency). In RAI 3.1.1-1, dated October 16, 2008, the staff requested that the applicant provide additional information regarding the activities used to detect degradation of small bore piping.

In its response to the RAI dated November 12, 2008, the applicant stated that Risk Informed ISI was/will be used to select socket welds for VT-2 examination and small-bore butt welds for ultrasonic and penetrant testing during the current third ten-year inspection interval. The staff noted that although welds selected for inspection are based on the RISI program, it is not clear if small-bore welds specific to the RCS and Core Flooding System will be subject to inspection such that the intent of the GALL AMP XI.M35 "monitoring and trending" element is met.

In RAI 3.1.1-2, dated January 5, 2009, the staff requested the applicant provide additional information indicating which small bore piping welds of the RCS and core flooding system receive volumetric or VT-2 inspection and to identify inspections and a schedule for welds in small bore piping where cracking has been discovered.

In its response to the RAI dated January 12, 2009, the applicant stated that risk informed methods are used to select RCS piping welds for inspection including small bore piping locations. The applicant also stated that "High" risk category small bore piping butt welds in the RCS have received volumetric inspection on a routine basis since a fatigue crack was discovered in the 2" cold leg drain line off the B cold leg reactor coolant piping in 1995. The applicant stated that volumetric examination of 2 ½ inch high pressure injection/makeup line butt welds were performed on one weld in 2005 and eight welds in 2007 with acceptable results. The applicant stated that no additional cracking was identified during inspections after the fatigue crack was discovered and that inspections of the replacement weld of the 2" cold leg drain line off the B cold leg reactor coolant piping were performed in 2001 (volumetric) and in 2003 (penetrant) with acceptable results. The applicant stated that inspection of corresponding weld off the D cold leg drain line was performed in 2003 (penetrant) with acceptable results and cold leg drain line welds A, B, and D are scheduled for bare metal visual and volumetric inspections in the Fall of 2009.

Based on its review, the staff finds the response to the RAIs acceptable because the inspections of ASME Code Class 1 small-bore piping which are implemented through the applicant's ISI program meets the applicable program elements of GALL AMP XI.M35. The staff noted that piping less than or equal to NPS 4 received volumetric inspection, that cracking was detected in ASME Code Class 1 small-bore piping, and that additional inspections have been performed and will be performed in the future consistent with ASME Section XI, Subsection IWB at a sufficient number of locations based on risk-informed ISI and augmented inspection at the 2" cold leg drain lines where cracking was discovered. The staff finds management of cracking in ASME Code

Class 1 small bore piping using the applicant's AMPs acceptable. The staff's concerns described in RAI 3.1.1-1 and 3.1.1-2 are resolved.

3.1.2.1.4 Conclusion for AMRs Consistent with the GALL Report

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing the associated aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the GALL Report AMRs. Therefore, the staff concludes that the applicant has demonstrated that the aging effects for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

LRA Section 3.1.2.2 provides further evaluation of aging management as recommended by the GALL Report for the RCS components. The applicant provided information concerning how it will manage the following aging effects:

- Cumulative Fatigue Damage
- Loss of Material due to General, Pitting, And Crevice Corrosion
- Loss of Fracture Toughness due to Neutron Irradiation Embrittlement
- Cracking due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking
- Crack Growth due to Cyclic Loading
- Loss of Fracture Toughness due to Neutron Irradiation Embrittlement and Void Swelling
- Cracking due to SCC
- Cracking due to Cyclic Loading
- Loss of Preload Due to Stress Relaxation
- Loss of Material due to Erosion
- Cracking due to Flow-Induced Vibration
- Cracking due to SCC, and Irradiated-Assisted SCC (IASCC)
- Cracking due to Primary Water Stress Corrosion Cracking (PWSCC)
- Wall Thinning due to Flow Accelerated Corrosion (FAC)

- Changes in Dimensions due to Void Swelling
- Cracking due to SCC and PWSCC
- Cracking due to SCC, PWSCC, and IASCC

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation. The staff determined whether the applicant adequately addressed the issues for which further evaluation is recommended. 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 states that fatigue is a TLAA, as defined in 10 CFR 54.3, which must be evaluated in accordance with 10 CFR 54.21(c)(1). LRA Table 3.1.1 identifies AMR Lines 3.1.1-1 and 3.1.1-5 through 3.1.1-10 as TLAA items for the reactor coolant system, the reactor vessel, the reactor vessel internals, and the steam generator. The applicant performed cumulative fatigue evaluations for these components. SER Section 4.3 documents the staff's review of the applicant's evaluation of TLAA for these components.

LRA Table 3.1.1, line items 2 – 4, discusses the applicant's determination on GALL AMR line items that are applicable only to BWR-designed reactors. In the applicant AMR discussions for line items 2 – 4, the applicant indicates that these line items are applicable to BWRs only and are not used for TMI-1. The staff confirmed that AMR line items 2 – 4, in Table 1 of the GALL Report, Volume 1 are only applicable to BWR designed reactors, and that TMI-1 is a pressurized water reactor with a dry ambient containment. Based on this determination, the staff finds that AMR line items 2 – 4, in Table 1 of the GALL Report, Volume 1 are not applicable to TMI-1.

SRP-LR Section 3.1.2.2.1 states that fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3 and TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The SRP-LR also states that this TLAA is addressed separately in Section 4.3, of the SRP-LR. For PWRs SRP-LR Section 3.1.2.2.1 invokes the AMRs on "cumulative fatigue damage" in AMR items 1, 5, 6, 7, 8, 9, and 10 of Table 1 to the GALL Report, Volume 1 and the plant-specific AMRs on "cumulative fatigue damage" for reactor vessel (RV) components, reactor vessel internal (RVI) components, RCS piping and pressurizer components, and SGs in Sections IV.A2, IV.B2, IVC2, and IV.D1 of the GALL Report Volume 1. In these AMRs, the GALL Report recommends that the PWR applicants credit their TLAAs on metal fatigue for management of "cumulative fatigue damage" in these components.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet 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 determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2.

(1) LRA Section 3.1.2.2.2.1 addresses loss of material due to general, pitting, and crevice corrosion in the steel steam generator shell assembly, the steel top head enclosure, and top head nozzles exposed to reactor coolant. The applicant stated that a One-Time Inspection Program will be implemented for susceptible locations to verify effectiveness of the Water Chemistry Program to manage loss of material due to general, pitting, and crevice corrosion in this component group which also includes steam generator level sensing and drain connections, main steam nozzle and safe ends, primary manway and inspection port covers, secondary manway and hand hole covers, and upper and lower tube sheets exposed to treated water and reactor coolant in the steam generator.

The staff reviewed LRA Section 3.1.2.2.2.1 against the criteria in SRP-LR Section 3.1.2.2.2.1, which states that loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. The SRP-LR states that loss of material due to general, pitting, and crevice corrosion could also occur for the steel top head enclosure (without cladding) top head nozzles [vent, top head spray or reactor core isolation cooling (RCIC), and spare] exposed to reactor coolant, and the existing program relies on control of reactor water chemistry to mitigate corrosion, but that control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions; therefore, effectiveness of the water chemistry control program should be confirmed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify effectiveness of the water chemistry control program. The SRP-LR states that one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.2, found that the Water Chemistry program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry," and provides mitigation for loss of material due to general, pitting and crevice corrosion. The staff reviewed the applicant's One-Time Inspection program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.14, found that the One-Time Inspection program is consistent with the GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material due to general, pitting or crevice corrosion at susceptible locations for components within the scope of the program. Based on the staff's determination that the Water Chemistry program provides mitigation and the One-Time Inspection program provides detection for the aging effect of loss of material due to general, pitting or crevice corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to general, pitting or crevice corrosion in the steel steam generator shell assembly to be acceptable.

(2) LRA Sections 3.1.2.2.2.2 through 3.1.2.2.2.4 refer to LRA Table 3.1.1, line items 11, and 13 – 15 that discuss the applicant's determination on GALL AMR line items that are applicable only to BWR-designed reactors. In the applicant AMR discussions for line items 11, and 13 – 15, the applicant indicates that these line items are applicable to BWRs only and are not used for TMI-1. The staff confirmed that AMR line items 11 and 13 – 15, in Table 1 of the GALL Report, Volume 1 are only applicable to BWR designed reactors, and that TMI-1 is a pressurized water reactor with a dry ambient containment. Based on this

determination, the staff finds that the applicant has provided an acceptable basis for concluding that AMR line items 11 and 13 – 15, in Table 1 of the GALL Report, Volume 1 are not applicable to TMI-1.

(3) LRA Table 3.1.1, line item 16 addresses steel steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam and discusses the applicant's determination on a GALL AMR line item that is applicable only to recirculating steam generators. The staff confirmed that AMR line item 16, in Table 1 of the GALL Report, Volume 1 is only applicable to recirculating steam generators and confirmed by reviewing various sections of the LRA, that TMI-1 has once through steam generators. Based on this determination, the staff finds that AMR line item 16, in Table 1 of the GALL Report, Volume 1 is not applicable to TMI-1.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2 criteria. For those line items that apply to LRA Section 3.1.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

The staff reviewed LRA Section 3.1.2.2.3 against the following criteria in SRP-LR Section 3.1.2.2.3:

(1) LRA Section 3.1.2.2.3 states that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA.

(2) LRA Section 3.1.2.2.3 addresses loss of fracture toughness due to neutron irradiation embrittlement. The applicant stated that participation in the MIRVSP, as described in B.2.1.17, manages this aging effect in low alloy steel components clad with stainless steel exposed to reactor coolant and neutron flux.

SRP-LR Section 3.1.2.2.3 states that loss of fracture toughness due to neutron irradiation embrittlement may occur in BWR and PWR reactor vessel beltline plates, forgings, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on factors such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in GALL Report Chapter XI, Section M31.

The applicant's reactor vessel surveillance program is documented in LRA Appendix B, Reactor Vessel Surveillance (B.2.1.17) and Section 4.2. The TMI-1 surveillance material contained in Capsule TMI2-LG2 was tested to meet the requirements of ASTM Standard E 185-82. By letter dated November 17, 2003 (ML033220292), the staff reviewed BAW-2439, "Babcock & Wilcox Owners Group Analysis of Capsule TMI2-LG2: Master

Integrated Reactor Vessel Surveillance Program." The wetted surface fluence values projected for 52 EFPY ranged from 1.177 x 10^{19} n/cm^2 to 1.971 x 10^{19} n/cm^2 (E > 1 MeV) for the TMI-1 beltline materials. Specimens from the TMI2-LG2 capsule received an average fast neutron fluence of 2.01 x 10^{19} n/cm^2 (E > 1 MeV). This meets the ASTM Standard E 185-82 criterion which states that capsules may be removed when the capsule neutron fluence is between one and two times the limiting fluence calculated for the vessel at the expected EOL. The surveillance specimens in the last capsule removed, Capsule TMI2-LG2, were exposed to fluences equivalent to approximately 60 years (52 EFPY) of vessel operation.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.3 criteria. For those line items that apply to LRA Section 3.1.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Cracking due to SCC and IGSCC

The staff reviewed LRA Section 3.1.2.2.4 against the criteria in SRP-LR Section 3.1.2.2.4.

(1) LRA Section 3.1.2.2.4 addresses cracking due to SCC and intergranular SCC (IGSCC), stating that this aging effect is not applicable to TMI-1 which is a PWR.

SRP-LR Section 3.1.2.2.4 states that cracking due to SCC and IGSCC may occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines.

The staff finds that SRP-LR Section 3.1.2.2.4, Item (1) is not applicable to TMI-1 because TMI-1 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWR-designed reactors.

(2) LRA Section 3.1.2.2.4 addresses cracking due to SCC and IGSCC, stating that this aging effect is not applicable to TMI-1 which is a PWR.

SRP-LR Section 3.1.2.2.4 states that cracking due to SCC and IGSCC may occur in stainless steel BWR isolation condenser components exposed to reactor coolant.

The staff finds that SRP-LR Section 3.1.2.2.4, Item (2) is not applicable to TMI-1 because TMI-1 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWR-designed reactors.

Based on the above, the staff concludes that the staff's guidance criteria of SRP-LR Section 3.1.2.2.4, Items (1) and (2) do not apply to TMI-1 because the guidance is applicable to BWR-designed reactors and TMI-1 is a PWR.

3.1.2.2.5 Crack Growth due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.5 against the criteria in SRP-LR Section 3.1.2.2.5.

In LRA Section 3.1.2.2.5, the applicant states that crack growth due to cyclic loading (underclad cracking) is a TLAA as defined in 10 CFR 54.3, which must be evaluated in accordance with 10 CFR 54.21(c)(1). The applicant performed fatigue crack growth and fracture toughness evaluations. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

SRP-LR Section 3.1.2.2.5 states that crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process. Growth of intergranular separations (underclad cracks) in the heat affected zone under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all SA 508-Cl 2 forgings where the cladding was deposited with a high heat input welding process.

The methodology for evaluating the underclad flaw should be consistent with the current well established flaw evaluation procedure and criterion in the ASME Section XI Code. See the SRP-LR, Section 4.7, "Other Plant-Specific Time-Limited Aging Analysis," for generic guidance for meeting the requirements of 10 CFR 54.21(c).

3.1.2.2.6 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement and Void Swelling

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6.

LRA Section 3.1.2.2.6 addresses loss of fracture toughness due to neutron irradiation embrittlement and void swelling in stainless steel and nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux. The applicant stated a commitment related to reactor vessel internals to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The applicant documented this commitment in LRA Appendix A, Section A.5, Commitment No. 36.

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6, which states that loss of fracture of toughness due to neutron irradiation embrittlement and void swelling may occur in stainless steel and nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux. The GALL Report recommends no further aging management review if the applicant provides a commitment in the UFSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff noted that the applicant's commitment stated in LRA Appendix A, Section A.5, is consistent with the commitment described in SRP-LR Section 3.1.2.2.6. The staff also noted that all of the AMR results lines that refer to LRA Table 3.1.1, item 3.1.1-22, are aligned with the applicant's commitment for inspection of reactor vessel internals. On the basis that the applicant provides the appropriate commitment in the UFSAR Supplement and applicable AMR results are appropriately aligned with that commitment, the staff finds the applicant's AMR results for stainless steel, nickel alloy, and cast austenitic stainless steel (CASS) reactor vessel internal components exposed to reactor coolant and neutron flux, with an aging effect of loss of fracture toughness due to neutron irradiation embrittlement and void swelling to be acceptable.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.6 criteria. For those line items that apply to LRA Section 3.1.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking due to SCC

The staff reviewed LRA Section 3.1.2.2.7 against the criteria in SRP-LR Section 3.1.2.2.7.

(1) LRA Section 3.1.2.2.7 addresses cracking due to SCC in the stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes. The applicant stated that this component, material, environment, and aging effect/mechanism does not apply in the reactor vessel, internals, and reactor coolant system. The GALL Report recommends a plant specific AMP to manage cracking due to SCC in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because the components are included with the reactor vessel system, class 1 piping, fittings and branch connections less than NPS 4". The applicant also stated that the components are stainless steel with an external environment of air with borated water leakage and an internal environment of reactor coolant and the AMR results for these components are included in LRA Table 3.1.2-2, and are shown on pages 3.1-74 and 3.1-75 of the LRA. The applicant also refers to its response to RAI 3.1.2.2.7-1. Based on its review of the LRA and the applicant's response to RAI 3.1.2.2.7-1, the staff confirmed that the components are included with the reactor vessel system, class 1 piping, fittings and branch connections less than NPS 4". The staff also confirmed that the components are stainless steel with an external environment of air with borated water leakage and an internal environment of reactor coolant and the AMR results for these components are included in LRA Table 3.1.2-2, and are shown on pages 3.1-74 and 3.1-75 of the LRA. The staff finds the applicant's determination acceptable.

SRP-LR Section 3.1.2.2.7.1 states that cracking due to SCC may occur in stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed.

In RAI 3.1.2.2.7-1, dated October 16, 2008, the staff requested that the applicant provide additional information to explain the basis for stating that the component, material, environment and aging effect/mechanism is not applicable.

In its response to the RAI, dated November 12, 2008, the applicant stated that the reactor vessel closure head flange leak detection line and the bottom-mounted instrument guide tubes are included in the evaluation of reactor vessel class 1 piping, fittings, and branch connections of less than 4 inch nominal pipe size (<NPS 4"). The applicant stated that the components are stainless steel with an external environment of air with borated water leakage and an internal environment of reactor coolant. The applicant further stated that the AMR results for these components are included in LRA Table 3.1.2-2 on pages 3.1-74 and 3.1-75 of the LRA.

The staff reviewed the AMR results identified by the applicant and noted that the AMR results lines identified by the applicant refer to LRA Table 3.1.1, item 3.1.1-70. The staff noted that the applicant proposed to manage the aging effect of cracking due to SCC in these components using the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, and the Water Chemistry program.

In RAI 3.1.2.2.7-2, dated January 5, 2009, the staff requested that the applicant provide additional information asking the applicant to explain how the examinations required by ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, for small-bore piping will detect cracking in the reactor vessel closure head flange leak detection line and the bottom-mounted instrument guide tubes.

In its response to the RAI, dated January 12, 2009, the applicant stated that the vessel closure head flange leak detection line is a 1" diameter blank flanged line and that, in accordance with ASME Code Section XI, IWB-1220, piping of NPS 1" and smaller is exempt from volumetric and surface examination requirements. The applicant further stated that during normal operation or during hydrostatic test (VT-2 examinations) the line does not contain reactor coolant and is not pressurized. The applicant stated that this line would see pressure only if there were a leak at the inner reactor vessel closure flange O-ring or if the annulus between the O-rings were pressurized, which is not a normal configuration, and that the normal internal environment for the flange leak detection line is air, which has no aging effects on stainless steel.

With regard to the bottom-mounted instrument guide tubes, the applicant stated that a bare metal visual examination is performed on the bottom-mounted instrument guide tube nozzles in accordance with 10 CFR 50.55a, and that there has been no indication of bottom-mounted instrumentation nozzle leakage, no lower RPV boric acid leakage, and no RPV base metal wastage observed. The applicant stated that in addition, VT-2 examinations are performed every outage on the ½" instrument guide tubes external to the vessel. The applicant stated that if indications of cracking or leakage are found in these components, an Issue Report is initiated to document the problem in accordance with the 10 CFR Part 50, Appendix B Corrective Action Program, and that corrective actions required by the applicant's program and ASME Code Section XI are implemented.

In evaluating the applicant's response with regard to the vessel head flange leak detection line, the staff noted that because the component is exempted from volumetric and surface examinations, and is not exposed to pressure during hydrostatic test, the applicant is, in fact, crediting only the Water Chemistry program for aging management of this component. The staff noted that this component normally is not a part of the reactor coolant pressure boundary, and that it is exposed to reactor coolant as part of the reactor coolant pressure boundary only if there is leakage past the inner reactor vessel closure flange O-ring. The staff also noted that the normal internal environment for this component is air, which does not have an aging effect on stainless steel components. On the basis that the normal internal environment is one where no aging effects are expected, the staff finds the applicant's crediting of the Water Chemistry program, alone, for aging management in the vessel head flange leak detection line to be acceptable.

In evaluating the applicant's response with regard to the bottom mounted instrument guide tubes, the staff noted that the applicant is currently implementing all inspections of these components required by ASME Code Section XI, plus additional inspections required by 10 CFR 50.55a. The staff further noted that the VT-2 examinations of the bottom mounted instrument guide tubes are performed at every refueling outage and provide on-going confirmation that cracking due to SCC has not occurred in these components. On the basis that ASME Code Section XI inspections, as augmented by additional 10 CFR 50.55a inspections, provide capability of detecting cracking due to SCC, if it should occur, and the

Water Chemistry program provides mitigation for the potential aging effect of cracking due to SCC in these components, the staff finds the applicant's crediting of the Water Chemistry program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program for aging management of the bottom mounted instrument guide tubes to be acceptable.

The staff's concerns described in RAIs 3.1.2.2.7-1 and 3.1.2.2.7-2 are resolved.

(2) LRA Section 3.1.2.2.7 addresses cracking due to SCC in class 1 cast austenitic stainless steel piping, piping components, and piping elements exposed to reactor coolant. The applicant stated that this component, material, environment, and aging effect/mechanism does not apply in the reactor vessel, internals, and reactor coolant system. The GALL Report recommends the Water Chemistry Program and for CASS components that do not meet the NUREG-0313 guidelines, a plant specific AMP to manage cracking due to stress corrosion cracking in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because with the exception of pump casings and valve bodies, there are no class 1 CASS piping, piping components, or piping elements in the reactor vessel, internals and reactor coolant system. The applicant also stated that cracking due to stress corrosion cracking in class 1 CASS pump casings and valve bodies is addressed by Item 3.1.1-68. The applicant also stated that item 3.1.1-24 specifies the Water Chemistry AMP and a plant specific AMP, while item 3.1.1-68 specifies the Water Chemistry AMP and ASME XI IWB, IWC, and IWD AMP. The applicant also stated that the ASME XI IWB, IWC, and IWD AMP is considered an acceptable plant specific program for managing cracking due to stress corrosion cracking in class 1 CASS pump casings and valve bodies. Based on its review of the LRA, the staff confirmed with the exception of pump casings and valve bodies, that there are no class 1 CASS piping, piping components, or piping elements in the reactor vessel, internals and reactor coolant system. The staff also confirmed that cracking due to stress corrosion cracking in class 1 CASS pump casings and valve bodies is addressed by item 3.1.1-68. The staff also confirmed that the ASME XI IWB, IWC, and IWD AMP is an acceptable plant specific program for managing cracking due to stress corrosion cracking in class 1 CASS pump casings and valve bodies. The staff finds the applicant's determination acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.7 criteria. For those line items that apply to LRA Section 3.1.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.8 Cracking due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8.

(1) LRA Section 3.1.2.2.8 addresses cracking due to cyclic loading stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.1.2.2.8 states that cracking due to cyclic loading may occur in the stainless steel BWR jet pump sensing lines.

The staff verified that SRP-LR Section 3.1.2.2.8, Item (1) is not applicable to TMI-1 because TMI-1 is a PWR and the staff guidance in this SRP-LR section is only applicable to BWR-designed reactors that are designed with stainless steel jet pump sensing lines.

(2) LRA Section 3.1.2.2.8 addresses cracking due to cyclic loading stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.1.2.2.8 states that cracking due to cyclic loading may occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant.

The staff verified that SRP-LR Section 3.1.2.2.8, Item (2) is not applicable to TMI-1 because TMI-1 is a PWR and the staff guidance in this SRP-LR section is only applicable to BWR-designed reactors that are designed with isolation condensers.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.8 criteria does not apply to TMI-1.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

LRA Section 3.1.2.2.9 addresses the applicant's aging management basis for managing loss of preload due to stress relaxation in stainless steel and nickel alloy vessel internals screws and bolts exposed to reactor coolant and neutron flux. The applicant stated a commitment related to reactor vessel internals to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The applicant documented this commitment in LRA Appendix A, Commitment No. 36.

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9, which states that loss of preload due to stress relaxation may occur in stainless steel and nickel alloy PWR reactor vessel internals screws, bolts, tie rods, and hold-down springs exposed to reactor coolant. The GALL Report recommends no further aging management review if the applicant provides a commitment in the UFSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff noted that the applicant's commitment stated in LRA Appendix A, Section A.5, is consistent with the commitment requirements described in SRP-LR Section 3.1.2.2.9. The staff also noted that all of the AMR results lines that refer to LRA Table 3.1.1, item 3.1.1-27, are aligned with the applicant's commitment for inspection of reactor vessel internals. On the basis that the applicant provides the appropriate commitment in the UFSAR Supplement and applicable AMR results are aligned with that commitment, the staff finds the applicant's AMR results for stainless steel and nickel alloy reactor vessel internal screws and bolts exposed to reactor coolant, with an aging effect of loss of preload to be acceptable.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.9 criteria. For those line items that apply to LRA Section 3.1.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.10 Loss of Material due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10.

LRA Section 3.1.2.2.10 addresses loss of material due to erosion that could occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater, stating that this component, material, environment, and aging effect/mechanism does not apply to the reactor vessel, internals, and reactor coolant system.

SRP-LR Section 3.1.2.2.10 states that loss of material due to erosion may occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater.
LRA Table 3.1.1, line item 28, discusses the applicant's determination on a GALL AMR line item that is applicable only to recirculating steam generators. The staff confirmed that AMR line item 28, in Table 1 of the GALL Report, Volume 1 is only applicable to recirculating steam generators and confirmed by reviewing various sections of the LRA, that TMI-1 has once through steam generators. Based on this determination, the staff finds that AMR line item 28 in Table 1 of the GALL Report, Volume 1 is not applicable to TMI-1.

Based on the above, the staff concludes that the recommended guidance in SRP-LR Section 3.1.2.2.10 does not apply to TMI-1.

3.1.2.2.11 Cracking due to Flow-Induced Vibration

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

LRA Section 3.1.2.2.11 addresses cracking due to flow-induced vibration by stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant.

The staff finds that SRP-LR Section 3.1.2.2.11 is not applicable to TMI-1 because TMI-1 is a PWR and the staff guidance in this SRP-LR section is only applicable to the design of steam dryers in BWR-designed reactors.

Based on the above, the staff concludes that the guidance in SRP-LR Section 3.1.2.2.11 does not apply to TMI-1.

3.1.2.2.12 Cracking due to SCC, and IASCC

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

LRA Section 3.1.2.2.12 addresses cracking due to SCC and IASCC in stainless steel reactor vessel internal components exposed to reactor coolant and neutron flux. The applicant stated a commitment related to reactor vessel internals to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The applicant stated that the aging effect of cracking due to SCC and IASCC will be managed by the Water Chemistry Program together with implementation of LRA Appendix A, Section A.5, Commitment No. 36.

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12, which states that cracking due to SCC and IASCC may occur in PWR stainless steel reactor internals exposed to reactor coolant and that the existing program relies on control of water chemistry to mitigate these effects. The GALL Report recommends no further aging management review if the applicant provides a commitment in the UFSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff reviewed the applicant's Water Chemistry program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.2, determined that the Water Chemistry program, with an enhancement, is consistent with the program described in GALL AMP XI.M2, "Water Chemistry" and that the Water Chemistry program provides mitigation for the aging effect of cracking due to SCC and IASCC in stainless steel components exposed to reactor coolant.

The staff reviewed the applicant's commitment related to the PWR Vessel Internals program in LRA Appendix A, Section A.5, Commitment No. 36. The staff also reviewed the AMR results lines in LRA Table 3.1.2-3 for stainless steel reactor vessel internal components exposed to reactor coolant and neutron flux, with an aging effect of cracking due to SCC and IASCC. The staff determined that the applicant provided a commitment for inspection of reactor vessel internals that is consistent with the commitment described in SRP-LR Section 3.1.2.2.12. The staff also determined that all of the applicable AMR results lines in LRA Table 3.1.2-3, as described above, are aligned with the applicant's commitment for inspection of reactor vessel internals and indicate that the Water Chemistry Program in combination with the commitment in the UFSAR Supplement is credited for managing the aging effect. Because the applicant provides the commitment in the UFSAR Supplement, as recommended in the SRP-LR and the GALL Report, and the applicant aligns appropriate AMR results with that commitment, indicating that both the Water Chemistry Program and the commitment are credited for aging management, the staff finds the applicant's AMR results to be consistent with the GALL Report. On this basis the staff finds the applicant's AMR results for stainless steel reactor vessel internal components exposed to reactor coolant and neutron flux, with an aging effect of cracking due to SCC and IASCC to be acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.12 criteria. For those line items that apply to LRA Section 3.1.2.2.12, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.13 Cracking due to PWSCC

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13.

LRA Section 3.1.2.2.13 states that the AMP B.2.1.1, "ASME Section XI Inservice Inspection program, Subsections IWB, IWC, and IWD," the B.2.2.1, "Nickel Alloy Aging Management program," and the AMP B.2.1.2, "Water Chemistry program," will be implemented to manage the aging effects of cracking due to primary water stress corrosion cracking in nickel alloy and steel with nickel-alloy cladding piping components, piping elements, penetrations, nozzles, safe ends, and welds; pressurizer sleeves, diaphragm plate exposed to reactor coolant and treated water in the Core Flooding System, Reactor Coolant System, Reactor Vessel, and Steam Generator.

The applicant stated that it complies with applicable NRC Orders and provides a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13, which states that cracking due to PWSCC could occur in PWR components made of nickel alloy and steel with nickel alloy cladding, including reactor coolant pressure boundary components and penetrations inside the RCS such as pressurizer heater sheathes and sleeves, nozzles, and other internal components. With the exception of reactor vessel upper head nozzles and penetrations, the GALL Report recommends ASME Section XI ISI (for Class 1 components) and control of water chemistry. For nickel alloy components, no further aging management review is necessary if the applicant complies with applicable NRC Orders and provides a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

The staff finds that the applicant has met the criteria of SRP-LR Section 3.1.2.2.13, because the applicant has committed in LRA Appendix A (Commitment 35) to implement NRC Bulletins and Generic Letters and industry guidelines to manage PWSCC of RCS components fabricated with nickel alloys including base metals and welds as part of LRA AMP B.2.2.1.

A revision to 10 CFR 50.55a, "Codes and Standards" was issued September 2008 which requires all licensee of pressurized water reactors to augment their inservice inspection programs to implement ASME Code Case N-722 which provides for additional detection capability for partial or full penetration welds in Class1 components fabricated with Alloy600/82/182 material pressure boundary leakage in pressurized water reactor plants. The applicant's LRA does not address the new provisions of 10 CFR 50.55a because it was submitted January 2008. The staff discussed this issue with the applicant, who indicated that the changes have been incorporated into an interim revision of the ISI Program and that its scheduling database has been updated to reflect the inspection requirements of ASME Code Case N-722. The applicant also indicated that there is no impact to any AMRs as a result of the revision to the regulation. The staff further discussed this issue with the applicant on June 29, 2009 who indicated that the ISI program and the corresponding basis document have been updated based on the revised requirements. Based on its review, the staff finds the applicant's implementation of the provisions of 10 CR 50.55a and ASME Code Case N-722, acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.13 criteria. For those line items that apply to LRA Section 3.1.2.2.13 the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging 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).

3.1.2.2.14 Wall Thinning due to FAC

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

LRA Section 3.1.2.2.14 addresses wall thinning due to flow-accelerated corrosion. The applicant stated that this line item is not applicable and further stated that wall thinning due to flow-accelerated corrosion in the steel feedwater inlet ring is discussed in Item Number 3.4.1-29.

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP Section 3.1.2.2.14, which states that wall thinning due to flow-accelerated corrosion, may occur in steel FW inlet rings and supports. The GALL Report references IN 91-19, “Steam Generator Feedwater Distribution Piping Damage,” for evidence of flow-accelerated corrosion in steam generators and recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting wall thinning due to flow-accelerated corrosion.

The corresponding GALL Report line item is IV.D1-26. For this line item, the GALL Report recommends a plant-specific program to be evaluated. The staff reviewed LRA Table 3.4.1, line item 3.4.1-29 and noted that there is no discussion of steel steam generator feedwater inlet ring. This line item further states that it is not consistent with the GALL Report and provides an explanation for the emergency feedwater system, only. In RAI 3.1.2.2.14-1, dated October 16, 2008, the staff requested that the applicant provide additional information to justify why line item 3.1.1-32 is not applicable and explain how the discussion in LRA Table 3.4.1, line item 3.4.1-29 is applicable to LRA Table 3.1.1, line item 3.1.1-32.

In its response to the RAI dated November 12, 2008, the applicant stated that Section 3.1.2.2.14 is for a feedwater inlet ring internal to the steam generator associated with Westinghouse and Combustion Engineering Recirculating Steam Generators and is not applicable to TMI-1, which is a Once Through Steam Generator. In order to eliminate confusion, the applicant revised LRA Table 3.1.1, line item 3.1.1-32 discussion to state the following:

> Not Applicable. See Subsection 3.1.2.2.14.

In addition, the applicant revised Section 3.1.2.2.14 of the LRA to state the following:

> Not Applicable. The discussion for Section 3.1.2.2.14 is for a feedwater inlet ring internal to the steam generator which is associated with Westinghouse and Combustion Engineering Steam Generators and is not applicable to TMI-1.

The staff reviewed the applicant’s response and the GALL Report. The staff noted that GALL Report Volume 2, item IV.D1-26 is applicable to Recirculating Type Steam Generators and there is no equivalent line item in the GALL Report in Section IV.D2 for Once Through Steam Generators. Based on this review, the staff finds the applicant response acceptable and concurs that Table 3.1.1, item 3.1.1-32 is not applicable for TMI-1. The staff’s concern described in RAI 3.1.2.2.14-1 is resolved.

Based on a review of the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.1.2.2.14 criteria. For those line items that apply to LRA Section 3.1.2.2.14 the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.15 Changes in Dimensions due to Void Swelling

The staff reviewed LRA Section 3.1.2.2.15 against the criteria in SRP-LR Section 3.1.2.2.15.

LRA Section 3.1.2.2.15 addresses changes in dimensions due to void swelling in stainless steel and nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux.

The applicant stated a commitment related to reactor vessel internals to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The applicant documented this commitment in LRA Appendix A, Final Safety Analysis Report Supplement, Section A.5, License Renewal Commitment List, Commitment No. 36.

The staff reviewed LRA Section 3.1.2.2.15 against the criteria in SRP-LR Section 3.1.2.2.15, which states that changes in dimensions due to void swelling may occur in stainless steel and nickel alloy PWR reactor internal components exposed to reactor coolant. The GALL Report recommends no further aging management review if the applicant provides a commitment in the UFSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff noted that the applicant's commitment stated in LRA Appendix A, Section A.5, is consistent with the commitment requirements described in SRP-LR Section 3.1.2.2.15. The staff also noted that all of the AMR results lines that refer to LRA Table 3.1.1, item 3.1.1-33 are aligned with the applicant's commitment for inspection of reactor vessel internals. On the basis that the applicant provides the appropriate commitment in the UFSAR Supplement and applicable AMR results are aligned with that commitment, the staff finds the applicant's AMR results for stainless steel and nickel alloy reactor vessel internals components exposed to reactor coolant and neutron flux, with an aging effect of changes in dimensions due to void swelling, to be acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.15 criteria. For those line items that apply to LRA Section 3.1.2.2.15, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.16 Cracking due to SCC and PWSCC

The staff reviewed LRA Section 3.1.2.2.16 against the criteria in SRP-LR Section 3.1.2.2.16.

(1) LRA Section 3.1.2.2.16 states that:

- The ASME Section XI Inservice Inspection Program, Subsections IWB, IWC, and IWD, B.2.1.1, and the Water Chemistry program, B.2.1.2, will be implemented to manage cracking due to stress corrosion cracking in stainless steel reactor control rod drive head penetration pressure housings.

- The ASME Section XI Inservice Inspection Program, Subsections IWB, IWC, and IWD, B.2.1.1, the Nickel Alloy Aging Management program, B.2.2.1, and the Water Chemistry program, B.2.1.2, will be implemented to manage cracking due to primary water stress corrosion cracking in nickel alloy and steel with nickel-alloy cladding reactor control rod drive head penetration pressure housings.

- The ASME Section XI Inservice Inspection Program, Subsections IWB, IWC, and IWD, B.2.1.1, and the Water Chemistry program, B.2.1.2, will be implemented to manage the aging effects of cracking due to stress corrosion cracking in steel with stainless steel cladding primary side components, steam generator upper and lower heads, and stainless steel tube support plates.

- The ASME Section XI Inservice Inspection Program, Subsections IWB, IWC, and IWD, B.2.1.1, and the Nickel Alloy Aging Management program, B.2.2.1, and the Water Chemistry program, B.2.1.2, will be implemented to manage the aging effects of cracking due to primary water stress corrosion cracking in steel with nickel-alloy cladding steam generator tubesheets. TMI-1 complies with applicable NRC Orders and provides a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

The staff reviewed LRA Section 3.1.2.2.16 against the criteria in SRP-LR Section 3.1.2.2.16 which states that cracking due to SCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. The SRP-LR states cracking due to PWSCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel alloy. The GALL Report recommends ASME Section XI ISI and control of water chemistry to manage this aging effect and recommends no further aging management review for PWSCC of nickel alloy if the applicant complies with applicable NRC Orders and provides a commitment in the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

The staff noted that in the LRA Appendix A (commitments 1 and 2) the applicant has committed to implement the ASME Section XI Inservice Inspection program and the Water Chemistry program as recommended by the GALL report to manage SCC of applicable stainless steel components and PWSCC of applicable nickel-alloy components. Also, the staff reviewed the applicant’s Nickel Aging Management program, B.2.2.1 in SER Section 3.0.3.3.1 and noted that the applicant has committed to implement applicable NRC Orders and provides a commitment (commitment 35) in LRA Appendix A to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines. Therefore, the staff finds that, based on a review of the programs identified above, no further aging management review for PWSCC of nickel alloy is required by the applicant.

A revision to 10 CFR 50.55a, “Codes and Standards” was issued September 2008 which requires all licensee of pressurized water reactors to augment their inservice inspection programs to implement ASME Code Case N-722 which provides for additional detection capability for partial or full penetration welds in Class1 components fabricated with

Alloy600/82/182 material pressure boundary leakage in pressurized water reactor plants. The applicant's LRA does not address the new provisions of 10 CFR 50.55a because it was submitted January 2008. The staff discussed this issue with the applicant who indicated that the changes have been incorporated into an interim revision of the ISI Program and that its scheduling database has been updated to reflect the inspection requirements of ASME Code Case N-722. The applicant also indicated that there is no impact to any AMRs as a result of the revision to the regulation. Based on its review, the staff finds the applicant's implementation of the provisions of 10 CFR 50.55a and ASME Code Case N-722, acceptable.

(2) LRA Section 3.1.2.2.16 addresses cracking due to stress corrosion cracking and primary water stress corrosion cracking in the nickel alloy pressurizer spray head. The applicant stated that the pressurizer spray head does not perform an intended function and is not in scope for license renewal for the reactor vessel, internals and reactor coolant system.

The staff confirmed that the pressurizer spray head is not part of the reactor coolant pressure boundary and that it does not perform a license renewal intended function. Because the pressurizer spray head does not perform a license renewal intended function, the staff finds that an aging management review of the pressurizer spray head is not required. On this basis, the staff finds it acceptable for the applicant to designate LRA Table 3.1.1, line item 3.1.1-36, as not applicable.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.16 criteria. For those line items that apply to LRA Section 3.1.2.2.16 the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.17 Cracking due to SCC, PWSCC, and IASCC

The staff reviewed LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17.

LRA Section 3.1.2.2.17 addresses the applicant's aging management basis for managing cracking due to SCC, PWSCC, and IASCC in stainless steel and nickel alloy reactor vessel components exposed to reactor coolant and neutron flux. The applicant stated a commitment related to reactor vessel internals to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The applicant stated that the aging effect of cracking due to SCC, PWSCC, and IASCC will be managed by the Water Chemistry program together with implementation of the commitment, which is documented in LRA Appendix A, Final Safety Analysis Report Supplement, Section A.5, License Renewal Commitment List, Commitment No. 36.

The staff reviewed LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17, which states that cracking due to SCC, PWSCC, and IASCC may occur in stainless steel and nickel alloy reactor vessel internals components. The SRP-LR states that the existing program relies on control of water chemistry to mitigate these effects; however, the existing program should be augmented to manage these aging effects for reactor vessel internals components.

The GALL Report recommends no further aging management review if the applicant provides a commitment in the UFSAR Supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff reviewed the applicant's Water Chemistry program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.2, determined that the Water Chemistry program, with an enhancement, is consistent with the program described in GALL AMP XI.M2, "Water Chemistry" and that the Water Chemistry program provides mitigation for the aging effect of cracking due to SCC, PWSCC and IASCC in stainless steel components exposed to reactor coolant.

The staff reviewed LRA Appendix A, Commitment No. 36, that relates to the PWR Vessel Internals program. The staff also reviewed the AMR results lines in LRA Table 3.1.2-3 for stainless steel reactor vessel internal components exposed to reactor coolant and neutron flux, with an aging effect of cracking due to SCC, PWSCC, and IASCC. The staff determined that the applicant provided a commitment for inspection of reactor vessel internals that is consistent with the commitment described in SRP-LR Section 3.1.2.2.17. The staff also determined that all of the applicable AMR results lines in LRA Table 3.1.2-3, as described above, are aligned with the applicant's commitment for inspection of reactor vessel internals and indicate that the Water Chemistry program in combination with the UFSAR commitment is credited for managing the aging effect. Because the applicant provides the commitment in the UFSAR Supplement, as recommended in the SRP-LR and the GALL Report, and the applicant aligns appropriate AMR results with that commitment, indicating that both the Water Chemistry program and the commitment are credited for aging management, the staff finds the applicant's AMR results to be consistent with the GALL Report. On this basis the staff finds the applicant's AMR results for stainless steel reactor vessel internals components exposed to reactor coolant and neutron flux, with an aging effect of cracking due to SCC, PWSCC and IASCC to be acceptable.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.17 criteria. For those line items that apply to LRA Section 3.1.2.2.17, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's QA program.

3.1.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.1.2-1 through 3.1.2-4, the staff reviewed additional details of 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, the applicant indicated, via 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 concerning how the aging effects will be managed. 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 had demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.1.2.3.1 Reactor Coolant System – Reactor Coolant System – 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 coolant system component groups.

For nickel alloy piping and fittings, pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges (Heater Bundle Diaphragm & Instrumentation Nozzle Safe Ends and Heater Sleeve), Pressurizer surge and steam space nozzles, and welds, reactor coolant pressure boundary components, and thermowells exposed to an air with borated water leakage (external) environment, the applicant assigned no aging effect and therefore no aging management program was assigned for these component/material/environment combinations.

The staff noted that austenitic materials such as nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2, April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

The applicant stated that for gray cast iron pump casings and carbon steel valve bodies exposed to a lubricating oil environment in the reactor coolant system (Table 3.1.2-1), the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. The staff reviewed the GALL Report and concluded that the AMR line item, gray cast iron pump casings and carbon steel valve bodies is not evaluated for a lubricating oil environment for loss of material due to pitting, crevice, microbiologically influence. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, microbiologically influence corrosion for these components.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14 respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will perform one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these gray iron and carbon steel components through the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Reactor Coolant System – Reactor Vessel – 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 component groups.

The staff noted that austenitic materials such as nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to "Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2," EPRI NP-5769, April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

In LRA Table 3.1.2-2, the applicant proposed to manage loss of material/general, pitting and crevice corrosion for high strength low alloy steel bolting with yield strength of 150 ksi or greater externally exposed to air with borated water leakage on mechanical closure bolting components using the Reactor Head Closure Studs Program. The AMR line item cites Generic Note E, which indicates that the material, aging effect, and environment are consistent with the NUREG-1801: however, a different aging management program is credited.

The staff reviewed the applicant’s Reactor Head Closure Studs Program and its evaluation is documented in SER Section 3.0.3.2.3. The LRA states that the Reactor Head Closure Studs Program uses visual, surface, and volumetric examinations in accordance with NRC approved guidance to manage the effects of aging of loss of material/general, pitting and crevice corrosion. Therefore, the staff concludes that the management of loss of material/general, pitting and crevice corrosion for high strength low alloy steel bolting with yield strength of 150 ksi or greater externally exposed to air with borated water leakage on mechanical closure bolting components is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Reactor Coolant System – Reactor Vessel Internals – Summary of Aging Management Evaluation – LRA Table 3.1.2-3

The staff reviewed LRA Table 3.1.2-3, which summarize the results of AMR evaluations for the reactor vessel internals component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.1.2.1.

3.1.2.3.4 Reactor Coolant System – Steam Generators – Summary of Aging Management Evaluation – LRA Table 3.1.2-4

The staff reviewed LRA Table 3.1.2-4 which summarizes the results of AMR evaluations for the steam generator component groups.

The staff noted that austenitic materials such as nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2," April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the reactor coolant system, reactor vessel, reactor vessel internals, and steam generator 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 (ESF)

This section of the SER documents the staff's review of the applicant's AMR results for the ESF components and component groups of:

- Core Flooding System
- Decay Heat Removal System
- Makeup and Purification System (High Pressure Injection)
- Primary Containment Heating and Ventilation System
- Reactor Building Spray System
- Reactor Building Sump and Drain System

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESF components and component groups. LRA Table 3.2.1, "Summary of Aging Management Evaluations for the Engineered Safety Features," provides a summary comparison of its AMRs to those evaluated in the GALL Report for ESF 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 issue 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 ESF components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMPs to ensure the applicant's claim that certain AMPs were consistent with the GALL Report. The purpose of this audit was to examine the applicant's AMPs and related documentation and to verify the applicant's claim of consistency with the corresponding GALL Report AMPs. The staff did not repeat its review of the matters described in the GALL Report. The staff's evaluations of the AMPs are documented in SER Section 3.0.3.

The staff reviewed the AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Section 3.2.2.1 and 3.2.2.2.

The staff also reviewed the AMRs not consistent with or not addressed in the GALL Report. The review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Details of the staff's evaluation are discussed in SER Section 3.2.2.3.

For components which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.2-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.2 and addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system (3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.2.2.2.1)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.2.1-2)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks"	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.2)
Stainless steel containment isolation piping and components internal surfaces exposed to treated water (3.2.1-3)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.3)
Stainless steel piping, piping components, and piping elements exposed to soil (3.2.1-4)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.3)
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.2.1-5)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry One-Time Inspection	Consistent with GALL Report (See SER Section 3.2.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.2.1-6)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis One-Time Inspection	Consistent with GALL Report (See SER Section 3.2.2.2.3)
Partially encased stainless steel tanks with breached moisture barrier exposed to raw water (3.2.1-7)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.3)
Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) (3.2.1-8)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	One-Time Inspection Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.2.2.2.3)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.2.1-9)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis One-Time Inspection	Consistent with GALL Report (See SER Section 3.2.2.2.4)
Stainless steel heat exchanger tubes exposed to treated water (3.2.1-10)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.4)
Elastomer seals and components in standby gas treatment system exposed to air - indoor uncontrolled (3.2.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See Section 3.2.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel high-pressure safety injection (charging) pump miniflow orifice exposed to treated borated water (3.2.1-12)	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.	Yes	Water Chemistry One-Time Inspection	Consistent with GALL Report (See SER Section 3.2.2.2.6)
Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled (internal) (3.2.1-13)	Loss of material due to general corrosion and fouling	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See Section 3.2.2.2.7)
Steel piping, piping components, and piping elements exposed to treated water (3.2.1-14)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See Section 3.2.2.2.8)
Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water (3.2.1-15)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry One-Time Inspection	Consistent with GALL Report (See SER Section 3.2.2.2.8)
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.8)
Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil (3.2.1-17)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.2.9)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.2.1-18)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs (See Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not Applicable	Not applicable to PWRs (See Section 3.2.2.1.1)
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated or unborated) > 250°C (> 482°F) (3.2.1-20)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to PWRs (See Section 3.2.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel closure bolting exposed to air with steam or water leakage (3.2.1-22)	Loss of material due to general corrosion	Bolting Integrity	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel bolting and closure bolting exposed to air - outdoor (external), or air - indoor uncontrolled (external) (3.2.1-23)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Reactor Head Closure Studs External Surfaces Monitoring Bolting Integrity Program	Consistent with GALL Report (See SER Sections 3.2.2.1.2, 3.1.2.3.2)
Steel closure bolting exposed to air - indoor uncontrolled (external) (3.2.1-24)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program 10CFRPart 50 Appendix J	Consistent with GALL Report (See SER Section 3.2.2.1.5)
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water > 60°C (> 140°F) (3.2.1-25)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.2.1-26)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to closed cycle cooling water (3.2.1-27)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.2.1-28)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.2.1-29)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.2.1-30)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air - indoor uncontrolled (external); condensation (external) and air - outdoor (external) (3.2.1-31)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report
Steel piping and ducting components and internal surfaces exposed to air - indoor uncontrolled (Internal) (3.2.1-32)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report
Steel encapsulation components exposed to air - indoor uncontrolled (internal) (3.2.1-33)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to condensation (internal) (3.2.1-34)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-35)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to raw water (3.2.1-36)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.2.1-37)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Stainless steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-38)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components External Surfaces Monitoring Program Open-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.2.2.1.3)
Stainless steel heat exchanger components exposed to raw water (3.2.1-39)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water (3.2.1-40)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.2.1-41)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching of Materials	Consistent with GALL Report
Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water (3.2.1-42)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to soil (3.2.1-43)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Gray cast iron motor cooler exposed to treated water (3.2.1-44)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Aluminum, copper alloy > 15% Zn, and steel external surfaces, bolting, and piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-45)	Loss of material due to Boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report
Steel encapsulation components exposed to air with borated water leakage (internal) (3.2.1-46)	Loss of material due to general, pitting, crevice and boric acid corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated borated water > 250°C (> 482°F) (3.2.1-47)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Stainless steel or stainless-steel-clad steel piping, piping components, piping elements, and tanks (including safety injection tanks/accumulators) exposed to treated borated water > 60°C (> 140°F) (3.2.1-48)	Cracking due to stress corrosion cracking	Water Chemistry	No	Water Chemistry	Consistent with GALL Report (See SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water (3.2.1-49)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry or, Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.2.2.1.4)
Aluminum piping, piping components, and piping elements exposed to air - indoor uncontrolled (internal/external) (3.2.1-50)	None	None	No	None	Consistent with GALL Report
Galvanized steel ducting exposed to air - indoor controlled (external) (3.2.1-51)	None	None	No	None	Consistent with GALL Report
Glass piping elements exposed to air - indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water (3.2.1-52)	None	None	No	None	Consistent with the GALL Report
Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.2.1-53)	None	None	No	None	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.2.1-54)	None	None	No	None	Not applicable to TMI-1 (See SER Section 3.2.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.2.1-55)	None	None	No	None	Consistent with GALL Report
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas (3.2.1-56)	None	None	No	None	Consistent with GALL Report
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-57)	None	None	No	None	Consistent with GALL Report

The staff's review of the ESF component groups followed several approaches. One approach, documented in SER Section 3.2.2.1, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.2.2.2, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.2.2.3, discusses the staff's review of AMR results for components the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the ESF components is documented in SER Section 3.0.3.

3.2.2.1 AMR Results That Are Consistent with the GALL Report

In LRA Section 3.2.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects of ESF components:

(a) ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD
(b) Aboveground Steel Tanks
(c) Bolting Integrity Program
(d) Boric Acid Corrosion Program
(e) Buried Piping and Tanks Inspection
(f) External Surfaces Monitoring
(g) Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
(h) Lubricating oil Analysis
(i) Nickel Alloy Aging Management Program
(j) One-Time Inspection Program
(k) Open Cycle Cooling Water System
(l) Selective Leaching of Materials
(m) Time Limited Aging Analysis
(n) Water Chemistry

LRA Tables 3.2.2-1 to 3.2.2-6, summarize AMRs for the ESF components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant had claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed a review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line 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 line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note 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 line items to verify consistency with the GALL Report. The staff also determined whether the AMR line 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff confirmed whether the AMR line item of the different component was applicable to the component under review and 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 line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also 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.

LRA Tables 3.2.2-1 to 3.2.2-6, provide a summary of the AMR results for component types associated with the ESF. The summary information for each component type included intended function, material, environment, AERM, AMPs, GALL Report, Volume 2, item, cross reference to LRA Table 3.2.1, and generic and plant-specific notes related to consistency with the GALL Report.

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 verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs.

On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable and no further evaluation is required.

3.2.2.1.1 AMR Results Identified as Not Applicable

Based on its initial review, the staff could not determine the specific reason why the applicant considered LRA Table 3.2.1, line items 17, 21, 22, 25 – 27, 29, 30, 33, 36, 37, 39, 40, 42 – 44, 47, and 54 to be not applicable. In RAI-AMR-GENERIC-1, dated October 16, 2008, the staff requested that the applicant provide additional information regarding these not applicable items so the staff could complete its evaluation.

In its response to the RAI dated October 30, 2008, the applicant stated that "Not Applicable" has been used when the component, material and environment combination does not exist in the identified GALL system grouping and also when the component, material and environment combination does exist but the LRA Table 3.x.1 item was not used because a different Table 3.x.1 item was selected to manage the identified aging effect/mechanism.

Based on its review, the staff finds the applicant's response to RAI-AMR-GENERIC-1 unacceptable because the applicant did not provide the specific reasons it used to consider the subject line items in LRA Table 3.x.1 not applicable and the staff could not complete its review.

In RAI-AMR-GENERIC-2, dated January 5, 2009, the staff requested that the applicant indicate for each of the LRA Table 3.x.1 items where "not applicable" is listed in the "discussion" column, the specific reason why the item is considered not applicable to TMI-1. The staff also requested that if the component, material and environment does exist but the LRA Table 3.x.1 item was not used, that the applicant indicate what other 3.x.1 item was selected to manage the identified aging effect/mechanism.

In its response to the RAI dated January 12, 2009, the applicant provided a table identifying the specific reason(s) why a Table 3.x.1 item is not considered applicable to TMI-1.

Based on its review, the staff finds the applicant's response to RAI AMR-GENERIC-2 acceptable because the applicant provided the basis for LRA Table 3.x.1 line items identified as "not applicable." The staff's concern described in RAI AMR-GENERIC-2 is resolved.

LRA Table 3.2.1, line items 18 – 20, discusses the applicant's determination on GALL AMR line items that are applicable only to BWR-designed reactors. In the applicant AMR discussions for line items 18 – 20, no additional information is provided. The staff confirmed that AMR line items 18 – 20, in Table 1 of the GALL Report, Volume 1 are only applicable to BWR designed reactors, and that TMI-1 is a pressurized water reactor with a dry ambient containment. Based on this determination, the staff finds that AMR line items 18 – 20, in Table 1 of the GALL Report, Volume 1 are not applicable to TMI-1.

LRA Table 3.2.1, line item 17 addresses steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The GALL Report recommends the Buried Piping and Tanks Surveillance AMP to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil in engineered safety features systems is addressed by identical Item 3.3.1-19 from the auxiliary systems grouping. Based on its review of the LRA, the staff confirmed that steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil in engineered safety features systems is addressed by identical Item 3.3.1-19 from the auxiliary systems grouping and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 21 addresses high strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the Bolting Integrity AMP to manage cracking due to cyclic loading, stress corrosion cracking in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there is no high-strength steel closure bolting exposed to air with steam or water leakage in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the high strength closure bolting fabricated from steel exposed to air with steam or water leakage. Based on its review of the LRA, the staff confirmed that there is no high-strength steel closure bolting exposed to air with steam or water leakage in engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 22 addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the Bolting Integrity AMP to manage loss of material due to general corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there is no steel closure bolting exposed to air with steam or water leakage in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the closure bolting fabricated from steel exposed to air with steam or water leakage. Based on its review of the LRA, the staff confirmed that there is no steel closure bolting exposed to air with steam or water leakage in engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 25 addresses stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water greater than 60^{o} C (greater than 140^{o} F). The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage cracking due to stress corrosion cracking in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water greater than 60^{o}C (greater than 140^{o}F) in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from stainless steel exposed to closed cycle cooling water greater than 60^{o} C (greater than 140^{o} F). Based on its review of the LRA, the staff confirmed that there are no stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water greater than 60^{o}C (greater than 140^{o}F) in engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 26 addresses steel piping, piping components, and piping elements exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to general, pitting, and crevice corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no steel piping, piping components, and piping elements exposed to closed cycle cooling water in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from steel exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there are no steel piping, piping components, and piping elements exposed to closed cycle cooling water in engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 27 addresses steel heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to general, pitting, crevice, and galvanic corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because steel engineered safety features heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The applicant references LRA Section 2.1.6.1 and also states that this component, material, environment, and aging effect combination is addressed by item 3.3.1-47 from the auxiliary systems grouping since galvanic corrosion as identified in item 3.2.1-27 does not apply to these heat exchanger components. Based on its review of the LRA, the staff confirmed that steel engineered safety features heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The staff also confirmed that this component, material, environment, and aging effect combination is addressed by item 3.3.1-47 from the auxiliary systems grouping since galvanic corrosion as identified in item 3.2.1-27 does not apply to these heat exchanger components. The staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 29 addresses copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to pitting, crevice, and galvanic corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because copper alloy engineering safety features heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The applicant references LRA Section 2.1.6.1 and also states that this component, material, environment, and aging effect combination is addressed by item 3.3.1-51 from the auxiliary systems grouping. Based on its review of the LRA, the staff confirmed that copper alloy engineering safety features heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The staff also confirmed that this component, material, environment, and aging effect combination is addressed by item 3.3.1-51 from the auxiliary systems grouping. The staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 30 addresses stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage reduction of heat transfer due to fouling in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because stainless and copper alloy engineered safety features heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The applicant references LRA Section 2.1.6.1 and also stated that this component, material, environment, and aging effect combination is addressed by item 3.3.1-52 from the auxiliary systems grouping. Based on its review of the LRA, the staff confirmed that stainless and copper alloy engineered safety features heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The staff also confirmed that this component, material, environment, and aging effect combination is addressed by item 3.3.1-52 from the auxiliary systems grouping. The staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 33 addresses steel encapsulation components exposed to air-indoor uncontrolled (internal). The GALL Report recommends the Inspection of Internal Surfaces in

Miscellaneous Piping and Ducting Components AMP to manage loss of material due to general, pitting, and crevice corrosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no steel encapsulation components exposed to air-indoor uncontrolled (internal) in engineered safety features systems. The applicant also states that engineered safety features systems encapsulation components are stainless steel and not subject to aging effects in an air-indoor uncontrolled environment. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the encapsulation components fabricated from steel exposed to air-indoor uncontrolled (internal). The staff noted that GALL Item V.F-12, recommends that stainless steel does not exhibit aging effects requiring management or recommends an AMP for aging management.
Based on its review of the LRA, the staff confirmed that there are no steel encapsulation components exposed to air-indoor uncontrolled (internal) in engineered safety features systems and also that engineered safety features systems encapsulation components are stainless steel and therefore, are not subject to aging effects in an air-indoor uncontrolled environment. The staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 36 addresses steel heat exchanger components exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no steel heat exchanger components exposed to raw water in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the heat exchangers fabricated from steel exposed to raw water. Based on its review of the LRA, the staff confirmed that there are no steel heat exchanger components exposed to raw water in engineered safety features systems, and therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 37 addresses stainless steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because it does not predict the additional aging effect/mechanism of loss of material/fouling for stainless steel in raw water. The applicant also states that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.2.1-38. Based on its review of the LRA, the staff confirmed that the applicant predicts the additional aging effect/mechanism of loss of material/fouling for stainless steel in raw water. The staff also confirmed that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.2.1-38. The staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 39 addresses stainless steel heat exchanger components exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no stainless steel heat exchanger components exposed to raw water in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the heat exchangers fabricated from stainless steel exposed to raw water. Based on its review of the LRA, the staff confirmed that there are no stainless steel heat exchanger components exposed to raw water in engineered safety features systems, and, therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 40 addresses steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage reduction of heat transfer due to fouling in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no steel or stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the heat exchanger tubes (serviced by open-cycle cooling water) fabricated from steel and stainless steel exposed to raw water. Based on its review of the LRA, the staff confirmed that there are no steel or stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water in engineered safety features systems, and therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 42 addresses gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water. The GALL Report recommends the Selective Leaching of Materials AMP to manage loss of material due to selective leaching in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from gray cast iron exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there are no gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water in engineered safety features systems, and therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 43 addresses gray cast iron piping, piping components, piping elements exposed to soil. The GALL Report recommends the Selective Leaching of Materials AMP to manage loss of material due to selective leaching in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no gray cast iron piping, piping components, and piping elements exposed to soil in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from gray cast iron exposed to soil. Based on its review of the LRA, the staff confirmed that there are no gray cast iron piping, piping components, and piping elements exposed to soil in engineered safety features systems and, therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 44 addresses gray cast iron motor cooler exposed to treated water. The GALL Report recommends the Selective Leaching of Materials AMP to manage loss of material due to selective leaching in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no gray cast iron motor coolers exposed to treated water in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the motor cooler fabricated from gray cast iron exposed to treated water. Based on its review of the LRA, the staff confirmed that there are no gray cast iron motor coolers exposed to treated water in engineered safety features systems, and therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 47 addresses cast austenitic stainless steel piping, piping components, and piping elements exposed to treated borated water greater than 250^{o} C (greater than 482^{o}F). The GALL Report recommends the thermal Aging Embrittlement of CASS AMP to manage loss of fracture toughness due to thermal aging embrittlement in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because with the exception of valve bodies, there are no CASS piping, piping components, or piping elements in engineered safety features systems. The applicant also stated that the loss of fracture toughness due to thermal aging embrittlement in CASS valve bodies is addressed by item 3.1.1-55. Based on its review of the LRA, the staff confirmed that with the exception of valve bodies, there are no CASS piping, piping components, or piping elements in engineered safety features systems. The staff also confirmed that the loss of fracture toughness due to thermal aging embrittlement in CASS valve bodies is addressed by item 3.1.1-55. The staff finds the applicant's determination acceptable.

LRA Table 3.2.1, line item 54 addresses steel piping, piping components, and piping elements exposed to air-indoor controlled (external). The GALL Report recommends no AMP as there is no aging effect/mechanism. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there are no steel piping, piping components, and piping elements exposed to air - indoor controlled (external) in engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that TMI-1 does not have support systems that are part of the engineered safety features with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from steel exposed to air-indoor controlled (external). Based on its review of the LRA, the staff confirmed that there are no steel piping, piping components, and piping elements exposed to air - indoor controlled (external) in engineered safety features systems, and therefore, the staff finds the applicant's determination acceptable.

3.2.2.1.2 Loss of Material due to General, Pitting, and Crevice Corrosion

(1) LRA Table 3.2.1, Item 3.2.1-23 addresses loss of material due to general, pitting and crevice corrosion for steel bolting with its external surfaces exposed to outdoor air or uncontrolled indoor air in the reactor coolant system, reactor vessel and steam generator. The staff noted that for those AMR line items in LRA Section 3.1 in which the applicant references Item 3.2.1-23, the applicant listed the environment as air with borated water leakage, which is a more aggressive environment, compared to outdoor air or uncontrolled indoor air. The staff confirmed in LRA Section 3.1, that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program as recommended by the GALL Report.

    The LRA credits External Surfaces Monitoring Program to manage this aging effect for steel class 1 piping, fittings and branch connections less than NPS 4", equipment supports and foundations, flow venturi, nozzles, piping, fittings, pressure housings, pressurizer, pressurizer components, pump casings, reactor coolant pressure boundary components, reactor vessel components, valve bodies, and steam generator components in an air with borated water leakage environment only. The GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff noted from its review, that all AMR line items where the applicant referenced line Item 3.2.1-23 and credited the External Surfaces Monitoring Program, in LRA Section 3.1, are not bolting components with an intended function for mechanical closure. The staff further noted that the applicant referenced Item 3.2.1-23 of LRA Table 3.2.1 because there was not another applicable Table 1 line item in LRA Table 3.2.1 that corresponded to the same material, environment and aging effect combination.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to general, pitting and crevice corrosion for steel components exposed to air with borated water leakage environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, and the applicant monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

(2) LRA Table 3.2.1, line item 3.2.1-23, and LRA Table 3.3.1, line item 3.3.1-43, address loss of material due to general, pitting and crevice corrosion for steel bolting with their external surfaces exposed to outdoor air or uncontrolled indoor air in the core flooding system, decay heat removal system, primary containment heating and ventilation system and the reactor building sump and drain system. The staff noted that for those AMR line items in LRA Section 3.2, in which the applicant references Item 3.2.1-23 and Item 3.3.1-43, the applicant listed the environment as air with borated water leakage, which is a more aggressive environment, compared to outdoor air or uncontrolled indoor air. The staff confirmed in LRA Section 3.2 that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program, as recommended by the GALL Report.

The LRA credits the External Surfaces Monitoring Program to manage loss of material due to general, pitting and crevice corrosion for steel bolting, damper housing, ducting, filter housing, heat exchanger components, piping, fittings, pump casings and tank components in an air with borated water leakage environment only. The GALL Report recommends GALL AMP XI.M18, "Bolting Integrity" to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff noted from its review that all but one AMR line item that the applicant referenced in Item 3.2.1-23 and Item 3.3.1-43 and credited the External Surfaces Monitoring Program are not bolting components with an intended function for mechanical closure. The staff further noted that the applicant referenced Item 3.2.1-23 of LRA Table 3.2.1 and Item 3.3.1-43 of LRA Table 3.3.1

because there was not another applicable Table 1 line item in LRA Table 3.2.1 and LRA Table 3.3.1 that corresponded to the same material, environment and aging effect combination. The staff confirmed that for the one AMR line item in this review that is a bolting component with an intended function for mechanical closure, the applicant has also credited the Bolting Integrity Program, which is recommended by the GALL Report. The staff noted that the applicant has taken a conservative approach by crediting the GALL recommended program, Bolting Integrity Program, and the External Surfaces Monitoring Program for periodic visual inspections of the components for this aging effect.

The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to general, pitting and crevice corrosion for steel components exposed to air with borated water leakage environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, and the fact that the applicant will be monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

Based on a review of the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.3 Loss of Material due to Pitting, Crevice, and Microbiologically-influenced Corrosion and Fouling

(1) LRA Tables 3.2.2-6 and 3.3.2-18 include AMR result lines referring to LRA Table 3.2.1, line item 3.2.1-38, that credits the External Surfaces Monitoring Program to manage the loss of material due to pitting and crevice corrosion and microbiologically-influenced corrosion (MIC) and fouling of the external surfaces of stainless steel components exposed to raw water in the reactor building sump and drain system and the miscellaneous floor and equipment drains system. LRA Tables 3.2.2-6, 3.3.2-18, 3.3.2-21 and 3.3.2-25 include AMR result lines referring to Table 3.2.1, line item 38, that credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to pitting and crevice and MIC and fouling of the internal surfaces of stainless steel components exposed to raw water in the reactor building sump and drain system, the miscellaneous floor and equipment drains system, the radwaste system, and the water treatment and distribution system. The staff noted that the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," for managing this aging effect in stainless steel components exposed to raw water, and the applicant cited generic note E for these AMR result lines, indicating that the material, environment, and aging effect are consistent with the GALL Report, but a different AMP is credited.

The staff reviewed the applicant's External Surfaces Monitoring Program, documented in SER Section 3.0.3.2.16, and the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, documented in SER Section 3.0.3.2.17, and confirmed that the applicant's programs include visual examinations similar to those recommended in GALL AMP XI.M20, "Open-Cycle Cooling Water System," for inspections for loss of material. Because the External Surfaces Monitoring

Program and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program both include visual examinations that are capable of detecting signs of corrosion, the staff finds that they are adequate to detect and manage loss of material due to pitting and crevice corrosion and MIC and fouling on the internal or external surfaces of stainless steel components exposed to raw water. On this basis, the staff finds that the applicant's use of these AMPs is adequate to manage the aging effects for which they are credited in LRA Table 3.2.1, item 3.2.1-38.

(2) LRA Table 3.2.1, Item 3.2.1-38 addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling for stainless steel components with their internal and external surfaces exposed to raw water in the miscellaneous floor and equipment drains system, the radwaste system and the water treatment and distribution system. The staff noted that the applicant referenced line item 3.2.1-38 of LRA Table 3.2.1 because there was not an applicable Table 1 line item in LRA Table 3.3.1 that corresponded to the same material, environment and aging effect combination.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for stainless steel piping, piping components, flow components, pump casings, heat exchanger components, tanks and valve body components in a raw water (internal) environment only. The GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff confirmed that only piping, piping components, and piping elements fabricated from stainless steel material are applicable to TMI-1 and align to the GALL Report item V.C-3. The staff noted that these AMR Line items in the reactor building sump and drain system are not in the scope of an open-cycle cooling water system as described in GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," and, therefore, are not with in the scope of GALL AMP XI.M20, "Open-Cycle Cooling Water System."

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff noted that the environment that these components are exposed to is potentially contaminated raw water in the radwaste system, which is not covered by a chemistry based AMP, and is not within the scope of the Open-Cycle Cooling Water System Program. The staff further noted that the sump drainage piping in the miscellaneous floor and equipment drains system is not part of the open-cycle cooling system. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling for stainless steel components exposed to raw water (internal) addressed by this AMR. On the basis of periodic visual inspections, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for stainless steel pump casing components in a raw water (external) environment only. The GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff noted that the environment that these components are exposed to is potentially contaminated raw water, which is not covered by a chemistry based AMP and is not within the scope of the Open-Cycle Cooling Water System Program. The staff determined that the External Surfaces Monitoring program, which includes periodic visual inspections of external surfaces during system walkdowns, is adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling for stainless steel components exposed to raw water (external) addressed by this AMR. On the basis of periodic visual inspections, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

Based on a review of the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.4 Loss of Material due to Pitting and Crevice Corrosion

LRA Table 3.2.2-6 includes AMR results for stainless steel piping and fittings and valve bodies in an environment of treated water referring to Table 3.2.1, line item 3.2.1-49. For these AMR results the applicant cited a plant-specific note stating that portions of the reactor building sump and drain system provide for drainage of reactor grade borated water and that based on plant operating experience, aging effects are expected to progress very slowly in the environment. The note also states that for some of these components the local environment may be more adverse than generally expected and the One-Time Inspection Program will augment the Water Chemistry Program by verifying the absence of aging effects. For the AMR results lines that indicate augmentation with the One-Time Inspection Program, the applicant cited Generic Note E, indicating that the result is consistent with the GALL report for material, environment, and aging effect, but a different AMP is used. The staff reviewed the applicant's One-Time Inspection Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material due to pitting and crevice corrosion at susceptible locations. Since the One-Time Inspection Program is used as an augmentation of the AMP recommended in the GALL report and provides added assurance that the aging effect is not present or is progressing slowly, the staff finds the AMPs specified by the applicant for these AMR result lines to be acceptable.

LRA Table 3.5.1, Item 3.5.1-50 addresses loss of material due to pitting and crevice corrosion for stainless steel components with their internal surfaces exposed to outdoor air in the reactor building spray system. The staff noted that the applicant referenced Item 3.5.1-50 of LRA Table 3.5.1 because there was not an applicable Table 1 line item in LRA Table 3.2.1 that corresponded to the same material, environment and aging effect combination. The staff confirmed the applicant is monitoring the inventory portion of the tank with the Water Chemistry Program and a One-Time

Inspection Program for loss of material due to pitting and crevice corrosion, which is consistent with the recommendations of the GALL Report.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, to manage this aging effect for stainless steel tanks in an internal outdoor air environment only. The GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff confirmed that only components that align to GALL Item III.B2-7 and are fabricated from stainless steel materials, are applicable to TMI-1.
The staff's evaluation of the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.2.17. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel components exposed to internal outdoor air environment addressed by this AMR. The staff further noted that this is consistent with those activities recommended by GALL AMP XI.S6, “Structures Monitoring Program.” On the basis of periodic visual inspections, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable.

LRA Table 3.5.1, Item 3.5.1-50 addresses loss of material due to pitting and crevice corrosion for stainless steel components with their external surfaces exposed to outdoor air in the Reactor Building Spray System. The staff noted that the applicant referenced Item 3.5.1-50 of LRA Table 3.5.1 because there was not an applicable Table 1 line item in LRA Table 3.2.1 that corresponded to the same material, environment and aging effect combination.

The LRA credits the Aboveground Steel Tanks Program to manage this aging effect for stainless steel tanks in an outdoor air (external) environment only. The GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program,” to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's Aboveground Steel Tanks Program and its evaluation is documented in SER Section 3.0.3.2.11. During the audit, the staff noted that in the applicant's program basis document under the program description and the program element, “scope of program,” the outdoor carbon steel tanks that are within the scope of this program include only the condensate storage tank, fire service water head tank (altitude tank) and the sodium hydroxide tank, which are all fabricated of carbon steel. However, upon the review of the applicant's aging management review line items, the staff noted that this AMP was credited for aging management of the Sodium Thiosulfate Tank which is fabricated from stainless steel. In RAI B.2.1.15-1, dated September 29, 2008, the staff requested that the applicant provide additional information to clarify whether this program is credited for aging management for aboveground steel tanks fabricated of stainless steel and whether the Sodium Thiosulfate Tank requires a one-time UT inspection of the bottom of the tank.

In its response to the RAI dated October 20, 2008, the applicant stated that the Aboveground Steel Tanks Program, manages only carbon steel tanks and that the management of the Sodium

Thiosulfate Tank incorrectly credited this program. The applicant further stated that the External Surfaces Monitoring program, will be credited for aging management of the Sodium Thiosulfate Tank. The staff confirmed that the applicant's LRA amendment provided a detailed description of this change to LRA Table 3.2.2-5. On the basis of its review, the staff finds the applicant's response acceptable because (1) the applicant identified the error, (2) amended the LRA so that the Aboveground Steel Tanks Program was not inappropriately credited for aging management of this AMR line item and (3) the applicant has credited External Surfaces Monitoring Program for management of loss of material due to pitting and crevice corrosion for stainless steel in an external outdoor air environment.

LRA Table 3.5.1, Items 3.5.1-47 and 3.5.1-50, address loss of material due to pitting and crevice corrosion for copper alloys with less than 15% zinc and stainless steel components, respectively, with their external surfaces exposed to outdoor air in the decay heat removal system and the reactor building spray system. The staff noted that the applicant referenced Item 3.5.1-47 and Item 3.5.1-50 of LRA Table 3.5.1 because there was not an applicable Table 1 line item in LRA Table 3.2.1 that corresponded to the same material, environment and aging effect combination.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for copper alloys with less than 15% zinc piping and fitting components, and stainless steel piping, fitting, tank, heater, thermowell and valve body components in an outdoor air (external) environment only. The GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff determined that the External Surfaces Monitoring program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to pitting and crevice corrosion for copper alloys with less than 15% zinc and stainless steel components exposed to outdoor air (external) addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

Based on a review of the programs identified, the staff concludes that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.5 Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

LRA Table 3.5.2-14 includes AMR results for carbon and low alloy steel bolting in an environment of air (indoor) or air with borated water leakage referring to Table 3.2.1, Item 3.2.1-24. The applicant proposed to manage loss of preload/thermal effects, gasket creep, and self-loosening by using the 10 CFR Part 50, Appendix J Program. The staff's review of the 10 CFR Part 50, Appendix J Program is documented in SER Section 3.0.3.1.7. These line items reference Note E, and plant specific note 9 which states the following: "The aging effects/mechanisms of carbon and low alloy steel bolting in this environment include loss of preload due thermal effects, gasket creep, self-loosening. These aging effects/mechanisms are managed by the 10 CFR Part 50,

Appendix J Program." The staff finds that the 10 CFR Part 50, Appendix J Program is adequate to manage loss of preload/thermal effects, gasket creep, and self-loosening for these components; therefore, the credited AMP is appropriate in both cases. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

Based on the programs identified, the staff concludes that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

LRA Section 3.2.2.2 provides further evaluation of aging management as recommended by the GALL Report for the ESF components. The applicant 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
- Reduction of Heat Transfer due to Fouling
- Hardening and Loss of Strength due to Elastomer Degradation
- Loss of Material due to Erosion
- Loss of Material due to General Corrosion and Fouling
- Loss of Material due to General, Pitting, and Crevice Corrosion
- Loss of Material due to General, Pitting, Crevice, and Microbiologically-influenced Corrosion

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report and for which further evaluation is recommended, the staff audited and reviewed the applicant's evaluations to determine whether they adequately address those issues. In addition, the staff reviewed the applicant's further evaluations against the criteria 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 states that fatigue is a time-limited aging analysis (TLAA), as defined in 10 CFR 54.3, "Definitions." Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.2.2.2.2 Loss of Material due to Cladding Breach

The staff reviewed LRA Section 3.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.

LRA Section 3.2.2.2.2 addresses loss of material due to cladding breach for steel pump casings with stainless steel cladding exposed to treated borated water. In this section of the LRA, the applicant identified that this item is not applicable to TMI-1 because this component, material, environment, and aging effect/mechanism does not apply to Engineered Safety Features.

SRP-LR Section 3.2.2.2.2 states that loss of material due to cladding breach may occur in PWR steel pump casings with stainless steel cladding exposed to treated borated water and recommends further evaluation of a plant-specific AMP to ensure that aging effect is managed. SRP-LR Section 3.2.2.2.2 states that loss of material due to cladding breach may occur in pressurized-water reactor (PWR) steel pump casings with stainless steel cladding exposed to treated borated water.

The staff reviewed LRA Table 3.2.2-2, decay heat removal system, and Table 3.2.2-3, makeup and purification (high-pressure injection) system and determined that the pump casings are fabricated from stainless steel material and the applicant has included these pumps in Table 3.2.1, line items 3.2.1-48 and 3.2.1-49. On the basis that TMI-1 does not have steel pump casings with stainless steel cladding exposed to treated borated water, and because the stainless steel pump casings are included in other lines for aging management, the staff finds that SRP-LR Section 3.2.2.2.2 criteria do not apply.

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 criteria in SRP-LR Section 3.2.2.2.3.

(1) LRA Section 3.2.2.2.3 refers to Table 3.2.1, line item 3.2.1-3 and addresses loss of material due to pitting and crevice corrosion in stainless steel containment isolation piping and components internal surfaces exposed to treated water. The applicant stated that this component, material, environment, and aging effect/mechanism does not apply to ESF.

    SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The SRP-LR also states that the existing program relies on monitoring and control of water chemistry to mitigate degradation, and that a one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or is progressing very slowly such that the component’s intended function will be maintained during the period of extended operation.

    In the applicant’s response to RAI-AMR-GENERIC-2, the applicant stated that line item 3.2.1-3 is not applicable because this component, material, environment, and aging effect/mechanism combination is addressed by Item 3.2.1-49. The applicant also stated that as discussed in the "Discussion" column for Item 3.2.1-49 in LRA Table 3.2.1, the Water Chemistry Program is augmented by the One-Time Inspection Program for treated (borated) water in the reactor building sump and drain system and that in the latter case, the Table 2 AMR line item was identified with an "E" Standard Note and a plant specific note stating the following:

> Portions of the reactor building sump and drain system provide for drainage or reactor grade borated treated water. Based on plant operating experience, aging effects are expected to progress very slowly in this environment, but the local environment may be more adverse than generally expected. The One-Time Inspection Program will augment the Water Chemistry Program by verifying the absence of aging effects.

Based on its review of the LRA, the staff confirmed that line item 3.2.1-3 is not applicable because this component, material, environment, and aging effect/mechanism combination is addressed by item 3.2.1-49. The staff also confirmed that the One-Time Inspection Program will augment the Water Chemistry Program by verifying the absence of aging effects. The staff finds the applicant's determination acceptable.

(2) LRA Section 3.2.2.2.3 refers to Table 3.2.1 item 3.2.1-4 and addresses loss of material from pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to soil.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The applicant stated that this component, material, environment, and aging effect/mechanism does not apply to ESF. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that line item 3.2.1-4 is not applicable because there are no stainless steel piping, piping components, and piping elements exposed to soil in engineered safety features systems. Based on its review of the LRA, the staff confirmed that there are no stainless steel piping, piping components, and piping elements exposed to soil in ESF systems, and therefore, the staff finds the applicant's determination acceptable.

(3) LRA Section 3.2.2.2.3.3 addresses loss of material due to pitting and crevice corrosion in aluminum piping, piping components, and piping elements and tanks exposed to treated water in the makeup and purification system (high pressure injection).

The applicant stated that the aging effect of loss of material due to pitting and crevice corrosion in these components will be managed by a combination of the Water Chemistry program and the One-time Inspection program.

The staff reviewed LRA Section 3.2.2.2.3 against the criteria in SRP-LR Section 3.2.2.2.3 which states that loss of material due to pitting and crevice corrosion may occur for BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The SRP-LR also states that the existing AMP monitors and controls water chemistry to mitigate degradation but does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be confirmed to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. The SRP-LR states that a one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff noted that the referenced section in the SRP-LR refers specifically to BWR components. With no similar AMR result line in the GALL Report for the same component, material and environment combination in PWRs, the staff finds the applicant's reference to this SRP-LR section to be acceptable because the same component, material, and environment combination results in the same aging effect in both a PWR and a BWR, and the same aging management programs are applicable for both reactor types. The staff reviewed the applicant's Water Chemistry Program. The staff's evaluation of that program, which is documented in SER Section 3.0.3.2.2, determined that the Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry."

The staff reviewed the applicant's One-Time Inspection Program. The staff's evaluation of that program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material due to pitting and crevice corrosion at susceptible locations for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of loss of material due to pitting or crevice corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to pitting or crevice corrosion in aluminum piping, piping components, and piping elements and tanks exposed to treated water in the makeup and purification system to be acceptable.

(4) LRA Section 3.2.2.2.3 states that the One-Time Inspection Program is implemented for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the loss of material due to pitting and crevice corrosion in stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil in the decay heat removal system and makeup and purification system (high pressure injection).

The staff reviewed LRA Section 3.2.2.2.3 against the criteria in SRP-LR Section 3.2.2.2.3 which states that loss of material from pitting and crevice corrosion could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR further states that the existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, and thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be confirmed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. The SRP-LR states a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis Program and One-Time Inspection Program and documents its review in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively and found that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and 2) will include one-time inspections of select stainless steel and copper alloy components exposed to lubricating oil for loss of material due to pitting and crevice corrosion to verify the effectiveness of the applicant's Lubricating Oil Analysis Program in applicable ESF systems. Therefore, the staff finds that, based on a review of the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.

(5) LRA Section 3.2.2.2.3 refers to Table 3.2.1 item 3.2.1-7 and addresses loss of material from pitting and crevice corrosion in partially encased stainless steel tanks exposed to raw water dues to cracking of the perimeter seal from weathering. The applicant stated that this component, material, environment, and aging effect/mechanism does not apply to ESF.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering.

In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that line item 3.2.1-7 is not applicable because there are no partially encased stainless steel tanks with breached moisture barriers exposed to raw water in engineered safety features systems. Based on its review of the LRA, the staff confirmed that there are no partially encased stainless steel tanks with breached moisture barriers exposed to raw water in ESF systems, and therefore, the staff finds the applicant's determination acceptable.

6a) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements and tanks exposed to internal condensation. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in stainless steel internal surfaces exposed to condensation (wetted air/gas). The staff reviewed LRA Section 3.2.2.2.3 against the criteria in SRP-LR Section 3.2.2.2.3, which states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components and piping elements exposed to internal condensation. The GALL report, under Item V.D2-35, V.A-26 and V.D1-29 recommends that a plant-specific program be credited to manage loss of material due to pitting and crevice corrosion for stainless steel piping, piping components, piping elements and tanks in the ESF Systems.

The staff confirmed that only piping, fittings, tanks and valve bodies that align to GALL AMRs V.D1-29 for the reactor building sump and drain system and the auxiliary and fuel handling building ventilation systems that are fabricated from stainless steel materials are applicable to TMI-1 that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the auxiliary and fuel handling building ventilation system in which the applicant has referenced Item V.D1-29 is not an ESF System, but it was grouped together with this GALL AMR item because the material, environment, and aging effect combination corresponded.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. Based on industry operating experience, the staff recognizes that stainless steel components exposed to condensation are not expected to experience significant degradation. As such, the staff considers the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be adequate to manage this aging effect because the program performs visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function.

The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements and tanks exposed to an internal environment of condensation.

(6b) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be used to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to a wetted gas internal environment in the auxiliary and fuel handling building ventilation systems, and reactor building sump and drain system. The applicant also stated that the One-Time Inspection Program will be used to manage loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, pump casings, and tanks exposed to a wetted gas internal environment in the containment isolation system, core flooding system, emergency feedwater system, radiation monitoring system, and reactor building spray system. The applicant further stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program consists of inspection of the internal surfaces of steel components that are not covered by other AMPs, and the inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. The applicant stated that the One-Time Inspection Program is credited for cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected, or (c) the characteristics of the aging effect include a long incubation period.

The staff reviewed LRA Section 3.2.2.2.3 against the criteria in SRP-LR Section 3.2.2.2.3 which states that loss of material due to pitting and crevice corrosion may occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff’s evaluation of this program, which is documented in SER Section 3.0.3.2.17, determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is consistent with GALL AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” with an acceptable exception, and is adequate to detect the presence or note the absence of loss of material due to pitting and crevice corrosion for components within the scope of the program, including components in a wetted gas environment. Based on the staff’s determination that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program provides detection for the potential aging effect of loss of material due to pitting or crevice corrosion, the staff finds the applicant’s proposed AMP for managing the aging effect of loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to a wetted gas internal environment in the auxiliary and fuel handling building ventilation systems, and reactor building sump and drain system to be acceptable.

The staff reviewed the applicant's One-Time Inspection program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material due to pitting and crevice corrosion at susceptible locations for components within the scope of the program, including components in a wetted gas environment.

Based on the staff's determination that the applicant's One-Time Inspection Program provides detection for the potential aging effect of loss of material due to pitting or crevice corrosion, the staff finds the applicant's proposed AMP for managing the aging effect of loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, pump casings, and tanks exposed to a wetted gas internal environment in the containment isolation system, core flooding system, emergency feedwater system, radiation monitoring system, and reactor building spray system to be acceptable.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3 criteria. For those line items that apply to LRA Section 3.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Reduction of Heat Transfer due to Fouling

The staff reviewed LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4.

(1) LRA Section 3.2.2.2.4 states that the One-Time Inspection Program will be implemented in susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the reduction of heat transfer due to fouling in copper alloy heat exchanger components exposed to lubricating oil in the Circulating Water System.

The staff reviewed LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4 which states that reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always have been adequate to preclude fouling. Therefore, the effectiveness of lube oil chemistry control should be confirmed to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control. The SRP-LR further states a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis Program and One-Time Inspection Program and documents its results in SER Sections 3.0.3.2.18 and 3.0.3.2.14 respectively and found that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude reduction of heat transfer due to fouling and 2) will perform one-time inspections of select stainless steel and copper alloy heat exchanger tubing exposed to lubricating oil for loss of heat transfer due to fouling in location most susceptible to degradation to verify the effectiveness of the Lubricating Oil Analysis Program in applicable ESF systems. Therefore, the staff finds that, based on a review of the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4.

(2) LRA Section 3.2.2.2.4 refers to Table 3.2.1 line item 3.2.1-10 and addresses reduction of heat transfer due to fouling in stainless steel heat exchanger tubes exposed to treated water. The applicant stated that this component, material, environment, and aging effect/ mechanism does not apply to ESF.

SRP-LR Section 3.2.2.2.4 states that reduction of heat transfer due to fouling may occur in stainless steel heat exchanger tubes exposed to treated water.

In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that line item 3.2.1-10 is not applicable because the component/material combination does not exist in engineered safety features systems. The applicant also stated that stainless steel engineered safety features heat exchanger components exposed to treated water have been included in the Auxiliary Systems Closed Cycle Cooling Water System. The applicant references LRA section 2.1.6.1 and states that this component, material, environment, and aging effect combination is addressed by item 3.3.1-3 from the auxiliary systems grouping. Based on its review of the LRA, the staff confirmed stainless steel engineered safety features heat exchanger components exposed to treated water have been included in the auxiliary systems closed cycle cooling water system. The staff confirmed that this component, material, environment, and aging effect combination is addressed by item 3.3.1-3 from the auxiliary systems grouping, and therefore, the staff finds the applicant's determination acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4 criteria. For those line items that apply to LRA Section 3.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Hardening and Loss of Strength due to Elastomer Degradation

The staff reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5.

LRA Section 3.2.2.2.5 addresses hardening and loss of strength due to elastomer degradation, stating that this aging effect is not applicable to TMI-1 which is a PWR. SRP-LR Section 3.2.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components of the BWR standby gas treatment system ductwork and filters exposed to air—indoor uncontrolled. This item is not applicable to TMI-1 because TMI-1 is a PWR. On this basis, the staff finds that SRP-LR 3.2.2.2.5 criteria do not apply to TMI-1. Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.5 criteria do not apply.

3.2.2.2.6 Loss of Material due to Erosion

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

LRA Section 3.2.2.2.6 addresses loss of material due to erosion in the stainless steel high-pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water. The applicant stated that the aging effect of loss of material due to erosion in these components will be managed by the Water Chemistry Program. The applicant stated that as further assurance, plant Technical Specifications (TS) require periodic surveillance testing of the pumps, which would give early indication of orifice degradation.

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6, which states loss of material due to erosion may occur in the stainless steel HPSI pump miniflow recirculation orifice exposed to treated borated water. The GALL Report recommends a plant-specific AMP be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. The GALL Report references Licensee Event Report (LER) 50-275/94-023 for evidence of erosion and recommends further evaluation to ensure that the aging effect is adequately managed.

The staff reviewed the applicant's Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.2, determined that the Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." Based on its review of the Water Chemistry Program, the staff found that the Water Chemistry Program is expected to mitigate the potential for erosion in the stainless steel HPSI miniflow orifice by controlling the build up of corrosion products and insoluble particulates that could contribute to abrasion and erosion. However, because the applicant was proposing no direct confirmation that erosion is not occurring or is progressing very slowly in the HPSI miniflow orifice, the staff determined the need for additional information. In RAI 3.2.2.2.6-1, dated October 16, 2008, the staff requested that the applicant provide additional information regarding a more direct method for detection of the aging effect or to justify that periodic surveillance of the HPSI pumps will be adequate to confirm that loss of material due to erosion is not occurring during the period of extended operation.

In its response to the RAI dated November 12, 2008, the applicant proposed an additional inspection to confirm directly that the Water Chemistry Program is effective in preventing erosion in the HPSI miniflow orifice. The applicant stated that the One-Time Inspection Program will be used to confirm the effectiveness of the Water Chemistry Program to manage loss of material due to erosion in the stainless steel high-pressure injection pump recirculation orifices. The applicant stated that an inspection of the orifice for the "B" pump will be performed because this is the pump most commonly used for normal charging and makeup flow. The applicant stated that this one-time inspection will consist of a volumetric examination and will be performed prior to entering the period of extended operation. The applicant also stated that appropriate changes to the LRA will be made to indicate that the aging effect of loss of material due to erosion in the stainless steel high-pressure safety injection pump miniflow orifice exposed to treated borated water will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed the applicant's RAI response and the One-Time Inspection Program. The staff's evaluation of the One-Time Inspection Program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection program is consistent with GALL AMP XI.M32, "One-Time Inspection," and that the One-Time Inspection program is capable of detecting loss of material and requires sample expansion and implementation of appropriate corrective actions if loss of material is found.

Based on the applicant's RAI response and the staff's review of the applicant's Water Chemistry and One-Time Inspection programs, the staff finds the applicant's proposed programs for managing the aging effect of loss of material due to erosion in the stainless steel HPSI miniflow orifice to be acceptable because the Water Chemistry program provides mitigation of the aging effect, and the One-Time Inspection Program provides confirmation of the Water Chemistry Program's effectiveness by direct examination of the HPSI miniflow orifice most likely to experience loss of material due to erosion. The staff's concern described in RAI 3.2.2.2.6-1 is resolved.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.6 criteria. For those lines that apply to LRA Section 3.2.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.7 Loss of Material due to General Corrosion and Fouling

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

LRA Section 3.2.2.2.7 addresses loss of material due to general corrosion and fouling and states that this aging effect is not applicable to TMI-1 which is a PWR.

SRP-LR Section 3.2.2.2.7 states that loss of material due to general corrosion and fouling may occur on steel drywell and the suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air—indoor uncontrolled and may cause plugging of the spray nozzles and flow orifices.

This item applies to BWR steel drywell and the suppression chamber spray system and is therefore not applicable to TMI-1 because TMI-1 is a PWR. On this basis, the staff finds that that SRP-LR Section 3.2.2.2.7 criteria do not apply to TMI-1.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.7 criteria do not apply.

3.2.2.2.8 Loss of Material due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.8 against the criteria in SRP-LR Section 3.2.2.2.8.

(1) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting, and crevice corrosion and states that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur in BWR steel piping, piping components, and piping elements exposed to treated water.

This line item is not applicable to TMI-1 because TMI-1 is a PWR. On this basis, the staff finds that the SRP-LR criteria do not apply to TMI-1.

(2) LRA Section 3.2.2.2.8 addresses loss of material due to general, pitting and crevice corrosion in steel piping, piping components, and piping elements, heat exchanger components, and tanks exposed to treated water in the decay heat removal system, makeup and purification (high pressure injection) system, radwaste system, reactor building spray system, and reactor building sump and drain system. The applicant stated that the aging effect of loss of material due to general, pitting and crevice corrosion in

these components will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed LRA Section 3.2.2.2.8 against the criteria in SRP-LR Section 3.2.2.2.8 which states that loss of material due to general, pitting, and crevice corrosion may occur on the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The SRP-LR also states that the existing AMP monitors and controls water chemistry to mitigate degradation but that control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be confirmed to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. The SRP-LR states that a one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.2, determined that the Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material at susceptible locations due to general, pitting and crevice corrosion for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of loss of material due to general, pitting and crevice corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to general, pitting and crevice corrosion in the steel piping, piping components, and piping elements, heat exchanger components, and tanks exposed to treated water in the decay heat removal system, makeup and purification (high pressure injection) system, radwaste system, reactor building spray system, and reactor building sump and drain system to be acceptable.

(3) LRA Section 3.2.2.2.8 refers to LRA Table 3.2.1, line item 3.2.1-16 and addresses loss of material due to general, pitting and crevice corrosion for steel piping, piping components, and piping elements. The applicant stated that this component, material, environment, and aging effect/mechanism does not apply to ESF.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting and crevice corrosion may occur for steel piping, piping components, and piping elements.

In its response to RAI-AMR-GENERIC-2, dated January 12, 2009, the applicant stated that the item is not applicable because TMI-1 predicts the additional aging effect/mechanism of loss of material/MIC for carbon steel in lubricating oil. The applicant also stated that this component, material, environment, and aging effect/mechanism combination is addressed by line item 3.4.1-12.

Based on its review of the LRA, the staff confirmed that TMI-1 predicts the additional aging effect/mechanism of loss of material/MIC for carbon steel in lubricating oil. The staff also confirmed that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-12. Based on this determination, the staff finds that the applicant's determination acceptable.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.8 criteria do not apply.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8 criteria. For those line items that apply to LRA Section 3.2.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.9 Loss of Material due to General, Pitting, Crevice, and Microbiologically-influenced Corrosion

The staff reviewed LRA Section 3.2.2.2.9 against the criteria in SRP-LR Section 3.2.2.2.9.

LRA Section 3.2.2.2.9 refers to LRA Table 3.2.1, line item 3.2.1-17 and addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion in steel (with or without coating or wrapping) piping, piping components, and piping elements in buried soil. The applicant stated that this component, material, environment, and aging effect/mechanism does not apply to engineered safety features.

SRP-LR Section 3.2.2.2.9 states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion may occur in steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil.

In its response to RAI-AMR-GENERIC-2, dated January 12, 2009, the applicant stated that the item is not applicable because steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil in engineered safety features systems is addressed by identical Item 3.3.1-19 from the auxiliary systems grouping.

Based on its review of the LRA, the staff confirmed that steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil in engineered safety features systems is addressed by identical Item 3.3.1-19 from the auxiliary systems grouping, and therefore, the staff finds that the applicant's determination acceptable.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.9 criteria do not apply.

3.2.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's QA program.

3.2.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-6, the staff reviewed additional details of 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 3.2.2-6, the applicant indicated, via 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 concerning how the aging effects will be managed. 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 had demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.2.2.3.1 Engineered Safety Features – Core Flooding 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 core flooding system component groups.

For nickel alloy piping, and fittings exposed to an air with borated water leakage (external) environment, the applicant assigned no aging effect and therefore no aging management program was assigned for these component/material/environment combinations.

The staff noted that austenitic materials such nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," Volumes 1 and 2, April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Engineered Safety Features – Decay 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 decay heat removal system component groups.

In LRA Table 3.2.2-2, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening of carbon and low alloy steel bolting externally exposed to outdoor air using the Bolting Integrity Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material. The AMR line item also cites Plant Specific Note 1, which indicates that the aging effect and program for the air-indoor uncontrolled environment are used.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures which follow NRC approved guidance. Additionally, the LRA line item is similar to GALL item VIII.H-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air- outdoor (external) environment. This environment consists of moist air, exposure to weather, precipitation, and wind. However, TMI-1 inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. Therefore, the staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening of carbon and low alloy steel bolting externally exposed to outdoor air is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Engineered Safety Features – Makeup and Purification System (High Pressure Injection) – Summary of Aging Management Evaluation – LRA Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the makeup and purification system (high pressure injection) component groups.

In LRA Table 3.2.2-3, the applicant designated Note H for copper alloy piping, fittings and valve bodies exposed to a lubricating oil environment in the makeup and purification system because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for copper alloy piping, fittings and valve bodies.

The staff reviewed the GALL Report and concluded that the AMR line item, copper alloy piping, fittings and valve bodies is not evaluated for a lubricating oil environment for loss of material due to pitting, crevice, microbiologically influence corrosion. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, microbiologically influence corrosion. The staff reviewed the Lubricating Oil Analysis Program and the One-time Inspection Program and documented its evaluation in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will include one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these copper alloy components through the period of extended operation.

In LRA Table 3.2.2-3, the applicant proposed to manage loss of material due to pitting and crevice corrosion for aluminum alloy material for electric heaters and tanks exposed to an air with borated water leakage (external) environment using the External Surfaces Monitoring program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.
The staff confirmed for these AMR line items in LRA Table 3.2.2-03, in which the applicant listed the environment as air with borated water leakage, that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program, as recommended by the GALL Report. The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff finds that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to general, pitting and crevice corrosion for aluminum alloy components exposed to air with borated water leakage environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, and the applicant will be monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

In LRA Table 3.2.2-3, the applicant stated that for PVC piping and fittings in lubricating oil internal environment and air with borated water leakage external environment, there are no aging effects requiring management. The applicant referenced footnote F stating that this material is not listed in the GALL Report for this component.

As identified in "Engineering Materials Handbook – Engineering Plastics," the staff noted that PVC is unaffected by water, concentrated alkalis, non-oxidizing acids, oils, ozone, sunlight, or humidity changes. The staff also noted that unlike metals, thermoplastics do not display corrosion rates, and rather than depend on an oxide layer for protection, they depend on chemical resistance to the environments to which they are exposed. The use of thermoplastics in power plant environments is a design-driven criterion. The staff acknowledges that plastic is an impervious material and once selected for the environment will not have any significant age related degradation. The staff has not observed any age related industry experience for plastic material in lubricating oil and air with borated water leakage environments. Based on this review, the staff finds that exposure of PVC materials to lubricating oil and air with borated water leakage environments will not result in aging effects that will be of concern during the period of extended operation.

In LRA Table 3.2.2-3, the applicant stated that for glass sight glasses and flow devices in air with borated water leakage external environment, there are no aging effects requiring management. The applicant referenced footnote "G" stating that this environment is not listed in the GALL Report for this component and material.

Although the applicant stated that this environment is not listed in the GALL Report for this component and material, the staff noted that the GALL Report item V.F-9 identifies glass piping components in treated borated water as having no aging effects requiring management. Based on this review, the staff finds that glass sight glasses and flow devices in air with borated water leakage external environment will have no aging effects requiring management during the period of extended operation because the air with borated water leakage environment is less aggressive than a treated borated water environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.4 Engineered Safety Features – Primary Containment Heating and Ventilation System – 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 primary containment heating and ventilation system component groups.

In LRA Table 3.2.2-4, the applicant proposed to manage reduction of heat transfer due to fouling for copper alloy with less than 15% zinc material for heat exchanger components exposed to an external indoor air environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff further noted that these periodic visual inspections are adequate to manage reduction of heat transfer due to fouling for these components exposed to external indoor air environment addressed by this AMR because a visual inspection will be capable of detecting any fouling (build up from whatever source) on the surface of these components. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections when exposed to an internal environment of external indoor air they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.2.2-4, the applicant proposed to manage loss of material/cracking asbestos material for expansion joints exposed to an indoor air environment using the External Surfaces Monitoring Program. The AMR line items cite Generic Note F, which indicates that the material is not addressed in the GALL Report for this environment.

Based on the staff's review of this AMR item, the staff felt that additional information was needed in regard to the aging effect that the applicant listed in LRA Table 3.2.2-4. In RAI B.2.1.21-1, dated September 29, 2008, the staff requested that the applicant provide additional information clarifying that this aging effect is in the scope of the program for asbestos and to justify the program's adequacy for managing this aging effect for asbestos.

In its response to the RAI dated October 20, 2008, the applicant stated that the asbestos cloth expansion joints are in the primary containment heating and ventilation system. The applicant further stated that during system walkdowns a visual inspection will be performed to identify cracked or missing material for the asbestos expansion joints.

Based on its review, the staff finds the applicant's response to RAI B.2.1.21-1 acceptable because the applicant will be inspecting these asbestos expansions joints to inspect for cracked or missing material which can be identified by a visual inspection.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff finds that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to cracking for asbestos components exposed to an indoor air environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

In LRA Table 3.2.2-4, the applicant proposed to manage loss of material/cracking asbestos material for expansion joints exposed to a wetted air/gas environment using the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note F, which indicates that the material is not addressed in the GALL Report for this environment.

Based on the staff's review of this AMR item, the staff felt that additional information was needed in regard to the aging effect that the applicant listed in LRA Table 3.2.2-4. In RAI B.2.1.22-1, dated September 29, 2008, the staff requested that the applicant provide additional information to clarify that this aging effect is in the scope of the program for asbestos and to justify the program's adequacy for managing this aging effect for asbestos.

In its response to the RAI dated October 20, 2008 the applicant stated that the asbestos cloth expansion joints are in the primary containment heating and ventilation system. The applicant further stated that during system walkdowns a visual inspection will be performed to identify cracked or missing material for the asbestos expansion joints.

Based on its review, the staff finds the applicant's response to the RAI acceptable because the applicant will be inspecting these asbestos expansion joints for cracked or missing material which can be identified by a visual inspection. RAI B.2.1.22-1 is resolved.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections for asbestos components to detect the aging effect of loss of material due to cracking when exposed to an internal wetted air/gas environment, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.2.2-4, the applicant proposed to manage loss of material due to pitting, crevice and microbiologically-influenced corrosion and fouling in valve bodies made of stainless steel exposed to an environment of raw water (internal) by using the Open-Cycle Cooling Water System Program. For these components the applicant cited Generic Note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for stainless steel in a raw water environment include loss of material due to pitting, crevice and microbiologically-influenced corrosion and fouling.

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects 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). GALL Report, Volume 2, item V.D1-25 provide AMR results for stainless steel piping, piping components, and piping elements exposed to raw water in PWR emergency core cooling systems. For this component, material, environment combination, the GALL Reports identifies the aging effect as loss of material due to pitting, crevice and microbiologically-influenced corrosion. The staff noted that the applicant identified fouling as an additional aging mechanism that could cause loss of material in stainless steel piping and valves exposed to raw water, and the applicant cited Generic Note H to indicate that an additional potential aging mechanism is identified. The staff also noted that the GALL Report includes loss of material due to fouling for other stainless steel components exposed to raw water. On the basis that the applicant identified a potential aging mechanism that is not listed in the GALL Report for this component, material, environment combination, the staff finds the applicant's identification of the additional aging mechanism and use of Generic Note H to be acceptable.

The staff reviewed the applicant's Open-Cycle Cooling Water System Program and its evaluation is documented in SER Section 3.0.3.2.5. The staff finds that the program, when enhanced, is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," with acceptable exceptions. The staff determined that the applicant's AMP includes preventive actions and inspections that are adequate to mitigate and detect the presence of loss of material due to pitting, crevice and microbiologically-influenced corrosion and fouling for components within the scope of the program. Based on the staff's determination that the Open-Cycle Cooling Water System Program provides both mitigation and detection for the potential aging effect of loss of material due to pitting, crevice and microbiologically-influenced corrosion and fouling, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to pitting, crevice and microbiologically-influenced corrosion and fouling corrosion in stainless steel valve bodies exposed to an environment of raw water in the primary containment heating and ventilation system to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.5 Engineered Safety Features – Reactor Building Spray System – Summary of Aging Management Evaluation – LRA Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the reactor building spray system component groups.

In LRA Table 3.2.2-5, the applicant proposed to manage loss of material/pitting and crevice corrosion for stainless steel bolting externally exposed to outdoor air using the Bolting Integrity Program. The AMR line item cites Generic Note E, which indicates that the material, aging effect, and environment are consistent with the GALL Report however a different aging management program is credited. The AMR line item also cites Plant Specific Note 2, which indicates that the aging effects and mechanisms of the cited line items are managed by the Bolting Integrity Program.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, microbiologically-influenced corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures which follow NRC approved guidance, and that components are inspected for loss of material/pitting and crevice corrosion using visual techniques. Additionally, degradation of closure bolting due to crack initiation, loss of pre-stress, or loss of material due to corrosion of the closure bolting would result in leakage. However, the staff found that frequency of inspections is conducted in accordance with ASME B&PV Code Section XI, Tables IWB 2500-1, IWC 2500-1, and IWD 2500-1, and is combined with periodic system walk downs to assure detection of leakage before the leakage becomes excessive. Therefore, the staff concludes that the management of loss of material/pitting and crevice corrosion for stainless steel bolting externally exposed to outdoor air is acceptable.

In LRA Table 3.2.2-5, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel and stainless steel mechanical closure bolting in an outdoor air (external) environment using the Bolting Integrity Program for 2 AMR line items. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination

The staff reviewed the applicant's Bolting Integrity Program as documented in SER Section 3.0.3.1.3. The applicant states in the LRA that this program manages the loss of material due to general, pitting and crevice corrosion, microbiologically-influenced corrosion (MIC) and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures which follow NRC approved guidance. Additionally, the LRA line items are similar to GALL item VIII.H-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air- outdoor (external) environment. This environment consists of moist air, exposure to weather, precipitation, and wind. However, TMI inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. Therefore, the staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel and stainless steel mechanical closure bolting in an outdoor air (external) environment is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.6 Engineered Safety Features – Reactor Building Sump and Drain System – 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 reactor building sump and drain system component groups.

In LRA Table 3.2.2-6, the applicant proposed to manage loss of material/pitting and crevice corrosion and loss of preload/thermal effects, gasket creep, and self loosening for stainless steel bolting externally exposed to raw water using the Bolting Integrity Program for 2 line items. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected for loss of material/pitting and crevice corrosion using visual techniques. Additionally, the two LRA line items are similar to GALL items VIII.H-4 and VIII.H-5, which account for an air-indoor uncontrolled (external) environment, but not a raw water (external) environment. Raw water is untreated water which may contain contaminants, including oil and boric acid, depending on the location, as well as originally treated water that is not monitored by a chemistry program. Raw water may lead to MIC, which is managed by the Bolting Integrity Program. Therefore, the staff concludes that the management of loss of material/pitting and crevice corrosion and loss of preload/thermal effects, gasket creep, and self loosening for stainless steel bolting externally exposed to raw water is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the ESF 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:

- Auxiliary and Fuel Handling Building Ventilation Systems
- Auxiliary Steam System
- Circulating Water System
- Closed Cycle Cooling Water System
- Containment Isolation System
- Control Building Ventilation System
- Cranes and Hoists
- Diesel Generator Building Ventilation System
- Emergency Diesel Generators and Auxiliary Systems
- Fire Protection System
- Fuel Handling and Fuel Storage System
- Fuel Oil System
- Hydrogen Monitoring
- Instrument and Control Air System
- Intake Screen and Pump House Ventilation System
- Intermediate Building Ventilation System
- Liquid and Gas Sampling System
- Miscellaneous Floor and Equipment Drains System
- Open Cycle Cooling Water System
- Radiation Monitoring System
- Radwaste System
- Service Building Chilled Water System
- Spent Fuel Cooling System
- Station Blackout and UPS Diesel Generator Systems
- Water Treatment & Distribution System

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3 provides AMR results for the auxiliary systems components and component groups. LRA Table 3.3.1, "Summary of Aging Management Programs for Auxiliary Systems," 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 auxiliary 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).

The staff conducted an onsite audit of AMPs to ensure the applicant's claim that certain AMPs were consistent with the GALL Report. The purpose of this audit was to examine the applicant's AMPs and related documentation and to verify the applicant's claim of consistency with the corresponding GALL Report AMPs. The staff did not repeat its review of the matters described in the GALL Report. The staff's evaluations of the AMPs are documented in SER Section 3.0.3.

The staff reviewed the AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Section 3.3.2.1 and 3.3.2.2.

The staff also reviewed the AMRs not consistent with or not addressed in the GALL Report. The review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Details of the staff's evaluation are discussed in SER Section 3.3.2.3.

For components which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.3-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.3 and addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel cranes - structural girders exposed to air - indoor uncontrolled (external) (3.3.1-1)	Cumulative fatigue damage	TLAA to be evaluated for structural girders of cranes. See the SRP-LR, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air - indoor uncontrolled, treated borated water or treated water (3.3.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.3.2.2.1)
Stainless steel heat exchanger tubes exposed to treated water (3.3.1-3)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Water Chemistry One-Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.2.2)
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution > 60°C (> 140°F) (3.3.1-4)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.3)
Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 60°C (> 140°F) (3.3.1-5)	Cracking due to stress corrosion cracking	A plant specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.3)
Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-6)	Cracking due to stress corrosion cracking	A plant specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.2.3)
Stainless steel non-regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-7)	Cracking due to stress corrosion cracking and cyclic loading	Water Chemistry and a plant-specific verification program. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.4)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-8)	Cracking due to stress corrosion cracking and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. A plant specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.4)
Stainless steel high-pressure pump casing in PWR chemical and volume control system (3.3.1-9)	Cracking due to stress corrosion cracking and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. A plant specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.4)
High-strength steel closure bolting exposed to air with steam or water leakage. (3.3.1-10)	Cracking due to stress corrosion cracking, cyclic loading	Bolting Integrity. The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes	Not Applicable	Not Applicable to TMI-1 (See SER Section 3.3.2.2.4)
Elastomer seals and components exposed to air - indoor uncontrolled (internal/external) (3.3.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components External Surface Monitoring	Consistent with GALL Report (See SER Section 3.3.2.2.5)
Elastomer lining exposed to treated water or treated borated water (3.3.1-12)	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Boral®, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water (3.3.1-13)	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry	Consistent with GALL Report (See SER Section 3.3.2.2.6)
Steel piping, piping component, and piping elements exposed to lubricating oil (3.3.1-14)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.7)
Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil (3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.7)
Steel reactor coolant pump oil collection system tank exposed to lubricating oil (3.3.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.7)
Steel piping, piping components, and piping elements exposed to treated water (3.3.1-17)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.7)
Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-18)	Loss of material/general (steel only), pitting and crevice corrosion	A plant specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.2.7)
Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil (3.3.1-19)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Yes	Buried Piping and Tanks Inspection program	Consistent with GALL Report (See SER Section 3.3.2.2.8)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, piping elements, and tanks exposed to fuel oil (3.3.1-20)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry One-Time Inspection and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL (See SER Section 3.3.2.2.9)
Steel heat exchanger components exposed to lubricating oil (3.3.1-21)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Not Consistent with GALL Report (See SER Section 3.3.2.2.9)
Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water (3.3.1-22)	Loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation)	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.10)
Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water (3.3.1-23)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.2.10)
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-24)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.2.10)
Copper alloy HVAC piping, piping components, piping elements exposed to condensation (external) (3.3.1-25)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring Program	Consistent with GALL Report (See SER Section 3.3.2.2.10)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.3.1-26)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.2.10)
Stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation (3.3.1-27)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.2.10)
Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-28)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Fire Protection Fire Water System Compressed Air Monitoring One Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.2.10)
Stainless steel piping, piping components, and piping elements exposed to soil (3.3.1-29)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Buried Piping and Tanks Inspection program	Consistent with GALL Report (See SER Section 3.3.2.2.10.)
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution (3.3.1-30)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.10)
Copper alloy piping, piping components, and piping elements exposed to treated water (3.3.1-31)	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.11)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-32)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry One-Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.2.12)
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components External Surfaces Monitoring Program Lubricating Oil Analysis One-Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.2.12)
Elastomer seals and components exposed to air - indoor uncontrolled (internal or external) (3.3.1-34)	Loss of material due to wear	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.13)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.3.1-35)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC IN 94-63, “Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks.”	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.2.14)
Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water (3.3.1-36)	Reduction of neutron-absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-37)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Reactor Water Cleanup System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-38)	Cracking due to stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Stainless steel BWR spent fuel storage racks exposed to treated water > 60°C (> 140°F) (3.3.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Steel tanks in diesel fuel oil system exposed to air - outdoor (external) (3.3.1-40)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Aboveground Steel Tanks	Consistent with GALL Report
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-41)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Steel closure bolting exposed to air with steam or water leakage (3.3.1-42)	Loss of material due to general corrosion	Bolting Integrity	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Steel bolting and closure bolting exposed to air - indoor uncontrolled (external) or air - outdoor (external) (3.3.1-43)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	External Surfaces Monitoring Program Bolting Integrity Program	Consistent with GALL Report (See SER Section 3.3.2.1.2)
Steel compressed air system closure bolting exposed to condensation (3.3.1-44)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel closure bolting exposed to air - indoor uncontrolled (external) (3.3.1-45)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program Inspection of Overhead Heavy Load and Light Load Handling Systems	Consistent with GALL Report (See SER Section 3.3.2.3.7)
Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water > 60°C (> 140°F) (3.3.1-46)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water (3.3.1-47)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water (3.3.1-48)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.3.2.1.15)
Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water (3.3.1-49)	Loss of material due to microbiologically-influenced corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.3.1-50)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.3.1-51)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.3.2.1.16)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.3.1-52)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System	Consistent with GALL Report
Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-53)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation (3.3.1-54)	Loss of material due to pitting and crevice corrosion	Compressed Air Monitoring	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Fire Protection Fire Water System Compressed Air Monitoring	Consistent with GALL Report (See SER Section 3.3.2.1.3)
Steel ducting closure bolting exposed to air - indoor uncontrolled (external) (3.3.1-55)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report
Steel HVAC ducting and components external surfaces exposed to air - indoor uncontrolled (external) (3.3.1-56)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report
Steel piping and components external surfaces exposed to air - indoor uncontrolled (external) (3.3.1-57)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel external surfaces exposed to air - indoor uncontrolled (external), air - outdoor (external), and condensation (external) (3.3.1-58)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Fire Protection External Surface Monitoring	Consistent with GALL Report (See SER Section 3.3.2.1.4)
Steel heat exchanger components exposed to air - indoor uncontrolled (external) or air -outdoor (external) (3.3.1-59)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air - outdoor (external) (3.3.1-60)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Fire Protection External Surfaces Monitoring Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Consistent with GALL Report (See SER Sections 3.3.2.1.5, 3.3.2.3.7)
Elastomer fire barrier penetration seals exposed to air - outdoor or air - indoor uncontrolled (3.3.1-61)	Increased hardness, shrinkage and loss of strength due to weathering	Fire Protection	No	Fire Protection	Consistent with GALL Report
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-62)	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Fire Water System Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.3.2.1.6)
Steel fire rated doors exposed to air - outdoor or air - indoor uncontrolled (3.3.1-63)	Loss of material due to wear	Fire Protection	No	Fire Protection Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Consistent with GALL Report (See SER Section 3.3.2.3.7)
Steel piping, piping components, and piping elements exposed to fuel oil (3.3.1-64)	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - indoor uncontrolled (3.3.1-65)	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Fire Protection Structures Monitoring Program	Consistent with GALL Report
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor (3.3.1-66)	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Fire Protection Structures Monitoring Program	Consistent with GALL Report
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor or air - indoor uncontrolled (3.3.1-67)	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring Program	No	Fire Protection Structures Monitoring Program	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion, and fouling	Fire Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring Program (B.2.1.21) Fire Water System	Consistent with GALL Report (See SER Section 3.3.2.1.7)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-69)	Loss of material due to pitting and crevice corrosion, and fouling	Fire Water System	No	Fire Water System	Consistent with GALL Report
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion, and fouling	Fire Water System	No	Fire Water System	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to moist air or condensation (internal) (3.3.1-71)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Fire Protection Compressed Air Monitoring Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.1.8)
Steel HVAC ducting and components internal surfaces exposed to condensation (internal) (3.3.1-72)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically -influenced corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Compressed Air Monitoring Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.3.2.1.9)
Steel crane structural girders in load handling system exposed to air - indoor uncontrolled (external) (3.3.1-73)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	Consistent with GALL Report
Steel cranes - rails exposed to air - indoor uncontrolled (external) (3.3.1-74)	Loss of material due to Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	Consistent with GALL Report
Elastomer seals and components exposed to raw water (3.3.1-75)	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements (without lining/ coating or with degraded lining/coating) exposed to raw water (3.3.1-76)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Open Cycle Cooling Water System	Consistent with GALL Report (See SER Sections 3.3.2.1.10, 3.3.2.1.17)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-78)	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Open-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.3.2.1.11)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-79)	Loss of material due to pitting and crevice corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-80)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Fire Water System	Consistent with GALL Report (See SER Section 3.3.2.1.12)
Copper alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Open Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.3.2.1.13)
Copper alloy heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.3.2.1.18)
Stainless steel and copper alloy heat exchanger tubes exposed to raw water (3.3.1-83)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water (3.3.1-84)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching	Consistent with GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water (3.3.1-85)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching	Consistent with GALL Report
Structural steel (new fuel storage rack assembly) exposed to air - indoor uncontrolled (external) (3.3.1-86)	Loss of material due to general, pitting, and crevice corrosion	Structures Monitoring Program	No	Fire Protection	Consistent with GALL Report (See SER Section 3.3.2.1.14)
Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water (3.3.1-87)	Reduction of neutron-absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.3.2.1.1)
Aluminum and copper alloy > 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-88)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report
Steel bolting and external surfaces exposed to air with borated water leakage (3.3.1-89)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report
Stainless steel and steel with stainless steel cladding piping, piping components, piping elements, tanks, and fuel storage racks exposed to treated borated water > 60°C (> 140°F) (3.3.1-90)	Cracking due to stress corrosion cracking	Water Chemistry	No	Water Chemistry, or Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.3.2.1.19)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and steel with stainless steel cladding piping, piping components, and piping elements exposed to treated borated water (3.3.1-91)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry, or Water Chemistry and One-Inspection	Consistent with GALL Report (See SER Section 3.3.2.1.19)
Galvanized steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (3.3.1-92)	None	None	No	None	Consistent with the GALL Report
Glass piping elements exposed to air, air - indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water (3.3.1-93)	None	None	No	None	Consistent with the GALL Report
Stainless steel and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.3.1-94)	None	None	No	None	Consistent with the GALL Report
Steel and aluminum piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.3.1-95)	None	None	No	None	Consistent with the GALL Report
Steel and stainless steel piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	No	None	Consistent with the GALL Report
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.3.1-97)	None	None	No	None	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air (3.3.1-98)	None	None	No	None	Consistent with the GALL Report
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-99)	None	None	No	None	Consistent with the GALL Report

The staff's review of the auxiliary systems component groups followed several approaches. One approach, documented in SER Section 3.3.2.1, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.3.2.2, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.3.2.3, discusses the staff's review of AMR results for components the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the auxiliary systems components is documented in SER Section 3.0.3.

3.3.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Aboveground Steel Tanks
- Bolting Integrity
- Boric Acid Corrosion
- Buried Piping and Tanks Inspection
- Closed Cycle Cooling Water System
- Compressed Air Monitoring
- External Surfaces Monitoring
- Fire Protection
- Fire Water System

- Flow-Accelerated Corrosion
- Fuel Oil Chemistry
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- One-Time Inspection
- Open Cycle Cooling Water System
- Selective Leaching of Materials
- Structures Monitoring Program
- TLAA
- Water Chemistry

LRA Tables 3.3.2-1 through 3.3.2-25 summarize AMRs for the auxiliary 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 had claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line 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 line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note 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 line items to verify consistency with the GALL Report. The staff also determined whether the AMR line 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and confirmed whether the AMR line 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. It 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 line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to verify consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.
The staff did not repeat its review of the matters described in the GALL Report; however, it did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the auxiliary systems components that are subject to an AMR.

On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

3.3.2.1.1 ARM Results Identified as Not Applicable

Based on its initial review, the staff could not determine the specific reason why the applicant considered LRA Table 3.3.1, line items 41, 42, 44, 49, 53, 64, 75, 77, 79, and 87 to be not applicable. In RAI-AMR-GENERIC-1, dated October 16, 2008, the staff requested that the applicant provide additional information regarding these not applicable items so the staff could complete its evaluation.

In its response to the RAI dated October 30, 2008, the applicant stated that "Not Applicable" has been used when the component, material and environment combination does not exist in the identified GALL system grouping and also when the component, material and environment combination does exist but the LRA Table 3.x.1 item was not used because a different Table 3.x.1 item was selected to manage the identified aging effect/mechanism.

Based on its review, the staff finds the applicant's response to RAI-AMR-GENERIC-1 unacceptable because the applicant did not provide the specific reasons it used to consider the subject line items in LRA Table 3.1.1 not applicable and the staff could not complete its review.

In RAI-AMR-GENERIC-2, dated January 5, 2009, the staff requested that the applicant indicate for each of the LRA Table 3.x. 1 items where "not applicable" is listed in the "discussion" column, the specific reason why the item is considered not applicable to TMI-1. The staff also requested that if the component, material and environment does exist but the LRA Table 3.x.1 item was not used, that the applicant indicate what other 3.x.1 item was selected to manage the identified aging effect/mechanism.

In its response to the RAI dated January 12, 2009, the applicant provided a table identifying the specific reason(s) why a Table 3.x.1 item is not considered applicable to TMI-1.

Based on its review, the staff finds the applicant's response to RAI AMR-GENERIC-2 acceptable because the applicant provided the basis for LRA Table 3.x.1 line items identified as "not applicable." The staff's concern described in RAI AMR-GENERIC-2 is resolved.

LRA Table 3.3.1, line items 36 – 39, discusses the applicant's determination on GALL AMR line items that are applicable only to BWR-designed reactors. In the applicant AMR discussions for line items 36 – 39, no additional information is provided. The staff confirmed that AMR line items 36 – 39, in Table 1 of the GALL Report, Volume 1 are only applicable to BWR designed reactors, and that TMI-1 is a pressurized water reactor with a dry ambient containment. Based on this determination, the staff finds that AMR line items 36 – 39, in Table 1 of the GALL Report, Volume 1 are not applicable to TMI-1.

LRA Table 3.3.1, line item 41 addresses high strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the Bolting Integrity AMP to manage cracking due to cyclic loading, stress corrosion cracking in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there is no high-strength steel closure bolting exposed to air with steam or water leakage in auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that TMI-1 does not have support systems that are part of the auxiliary systems with-in the scope of license renewal that contain the high strength closure bolting fabricated from steel exposed to air with steam or water leakage. Based on its review of the LRA, the staff confirmed that there is no high-strength steel closure bolting exposed to air with steam or water leakage in auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 42 addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the Bolting Integrity AMP to manage loss of material due to general corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this line item is not applicable because there is no steel closure bolting exposed to air with steam or water leakage in auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that TMI-1 does not have support systems that are part of the auxiliary systems with-in the scope of license renewal that contain the closure bolting fabricated from steel exposed to air with steam or water leakage. Based on its review of the LRA, the staff confirmed that there is no steel closure bolting exposed to air with steam or water leakage in auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 44 addresses steel compressed air system closure bolting exposed to condensation. The GALL Report recommends the Bolting Integrity AMP to manage loss of material due to general, pitting, and crevice corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there is no steel compressed air system closure bolting exposed to condensation in auxiliary systems. The staff reviewed LRA

Sections 2.3.3 and 3.3 and confirmed that TMI-1 does not have support systems that are part of the auxiliary systems with-in the scope of license renewal that contain the compressed air system closure bolting fabricated from steel exposed to condensation. Based on its review of the LRA, the staff confirmed that there is no steel compressed air system closure bolting exposed to condensation in auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 49 addresses stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to microbiologically-influenced corrosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this component, material, environment, and aging effect/mechanism combination does not exist in auxiliary systems. The applicant also stated that MIC is not predicted in closed cycle cooling water due to the lack of a MIC source. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that TMI-1 does not have support systems that are part of the auxiliary systems with-in the scope of license renewal that contain the heat exchanger components fabricated from stainless steel or steel with stainless steel cladding exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that this component, material, environment, and aging effect/mechanism combination does not exist in auxiliary systems and also that MIC is not predicted in closed cycle cooling water due to the lack of a MIC source. The staff finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 53 addresses steel compressed air system piping, piping components, and piping elements exposed to condensation (internal). The GALL Report recommends the Compressed Air Monitoring AMP to manage loss of material due to general and pitting corrosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this component, material, and environment combination is addressed by Item 3.3.1-71 since Item 3.3.1-53 does not include crevice corrosion, which is predicted for TMI-1 for this component, material, and environment combination. The applicant further stated that as discussed in the "Discussion" column for Item 3.3.1-71 in LRA Table 3.3.1, the Compressed Air Monitoring AMP has been substituted for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP and that in this case, the Table 2 AMR line item was identified with an "E" Standard Note and a plant specific note stating: "The aging effects of carbon steel in an air/gas - wetted (internal) environment include loss of material due to general, pitting, and crevice corrosion. These aging effects/mechanisms are managed by the Compressed Air Monitoring program." Based on its review of the LRA, the staff confirmed that this component, material, and environment combination is addressed by item 3.3.1-71 since item 3.3.1-53 does not include crevice corrosion, which is predicted for this component, material, and environment combination. The staff also confirmed that the Compressed Air Monitoring AMP has been substituted for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP. The staff finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 64 addresses steel piping, piping components, and piping elements exposed to fuel oil. The GALL Report recommends the Fire Protection and Fuel Oil Chemistry AMPs to manage loss of material due to general, pitting, and crevice corrosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that it predicts the additional aging mechanisms of MIC and fouling for steel components in fuel oil and that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.3.1-20. Based on its review of the LRA, the staff confirmed that the applicant predicts the additional aging mechanisms of MIC and fouling for steel components in fuel oil and that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.3.1-20. The staff finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 75 addresses elastomer seals and components exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage hardening and loss of strength due to elastomer degradation; loss of material due to erosion. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there are no elastomer seals and components exposed to raw water in auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that TMI-1 does not have support systems that are part of the auxiliary systems with-in the scope of license renewal that contain the seals and components fabricated from elastomers exposed to raw water. Based on its review of the LRA, the staff confirmed that there are no elastomer seals and components exposed to raw water in auxiliary systems, and, therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 77 addresses steel heat exchanger components exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage loss of material due to pitting and crevice corrosion in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that this component, material, environment, and aging effect combination is addressed by items 3.2.1-35, 3.3.1-68, and 3.3.1-76 since galvanic corrosion as identified in Item 3.3.1-77 does not apply to these heat exchanger components. The applicant also stated that the component, material, environment, and aging effect combination addressed by items 3.2.1-35 and 3.3.1-76 are managed by the Open-Cycle Cooling Water System AMP and that the raw water environment associated with floor and equipment drain systems and addressed by item 3.3.1-68 are managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP since Open-Cycle Cooling Water System AMP activities do not address waste raw water. Based on its review of the LRA, the staff confirmed that this component, material, environment, and aging effect combination is addressed by items 3.2.1-35, 3.3.1-68, and 3.3.1-76 since galvanic corrosion as identified in item 3.3.1-77 does not apply to these heat exchanger components. The staff also confirmed that the component, material, environment, and aging effect combination addressed by items 3.2.1-35 and 3.3.1-76 are managed by the Open-Cycle Cooling Water System AMP and that the raw water environment associated with floor and equipment drain systems and addressed by item 3.3.1-68 are managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP since Open-Cycle Cooling Water System AMP activities do not address waste raw waters. The staff finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 79 addresses stainless steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage loss of material due to pitting and crevice corrosion, and fouling in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that it predicts the additional aging mechanism of MIC for stainless steel components exposed to raw water and that this component, material, environment, and aging effect/mechanism combination is addressed by Items 3.2.1-38 and 3.4.1-33. The applicant also stated that circulating water system components in raw water are managed by the Open-Cycle Cooling Water System AMP and that components exposed to waste raw water environments are managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP since the Open Cycle Cooling Water System AMP activities do not address waste raw water. Based on its review of the LRA, the staff confirmed that the applicant predicts the additional aging mechanism of MIC for stainless steel components exposed to raw water and that this component, material, environment, and aging effect/mechanism combination is addressed by Items 3.2.1-38 and 3.4.1-33. The staff also confirmed that circulating water system components in raw water are managed by the Open-Cycle Cooling Water System AMP and that components exposed to waste raw water environments are managed by the Inspection of Internal Surfaces in Miscellaneous Piping and

Ducting Components AMP since the Open Cycle Cooling Water System AMP activities do not address waste raw water. The staff finds the applicant's determination acceptable.

LRA Table 3.3.1, line item 87 addresses boraflex spent fuel storage racks neutron absorbing sheets exposed to treated borated water. The GALL Report recommends the Boraflex Monitoring AMP to manage reduction of neutron absorbing capacity due to boraflex degradation in this component group. In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that there are no boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water in auxiliary systems and that the fuel storage racks are Boral® and are addressed by item 3.3.1-13. Based on its review of the LRA, the staff confirmed that there are no boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water in auxiliary systems and that the fuel storage racks are Boral and are addressed by item 3.3.1-13. The staff finds the applicant's determination acceptable.

3.3.2.1.2 Loss Of Material Due To General, Pitting, And Crevice Corrosion

LRA Table 3.3.1, Item 3.3.1-43 addresses loss of material due to general, pitting and crevice corrosion for steel components with its external surfaces exposed to outdoor air in the auxiliary and fuel handling building ventilation system.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for steel piping, fittings and valve body components in an outdoor air (external) environment only. The GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's External Surfaces Monitoring program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff noted from its review that all but one AMR line item that the referenced line item 3.3.1-43 and credited the External Surfaces Monitoring Program are not bolting components with an intended function for mechanical closure. The staff further noted that the applicant referenced Item 3.3.1-43 of LRA Table 3.3.1 because there was not another applicable Table 1 line item in LRA Table 3.3.1 that corresponded to the same material, environment and aging effect combination. The staff confirmed that for the one AMR line item in this review that is a bolting component with an intended function for mechanical closure that was listed, the applicant also credited the Bolting Integrity Program for managing loss of material due to general, pitting and crevice corrosion, which is consistent with the GALL Report. The staff noted that the applicant took a conservative approach by crediting the GALL recommended program, Bolting Integrity Program, and the External Surfaces Monitoring Program for periodic visual inspections of the components.

The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to general, pitting and crevice corrosion for steel components exposed to outdoor air (external) addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

LRA Table 3.2.1, Item 3.2.1-23, and LRA Table 3.3.1, Item 3.3.1-43 address loss of material due to general, pitting and crevice corrosion for steel components with their external surfaces exposed to outdoor air or uncontrolled indoor air in the auxiliary and fuel handling building ventilation system, the auxiliary steam system, closed cycle cooling water system, containment isolation system, instrument and control air system, miscellaneous floor and equipment drains system and the radwaste system. The staff noted that for those AMR line items in LRA Section 3.3, in which the applicant references Item 3.2.1-23 and Item 3.3.1-43, the applicant listed the environment as air with borated water leakage, which is a more aggressive environment, compared to outdoor air or uncontrolled indoor air. The staff confirmed in LRA Section 3.3, that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program, as recommended by the GALL Report.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for steel bolting, damper housing, ducting, filter housing, flow device, heat exchanger components, piping, fittings, pump casings, regulator, sight glass, spectacle blind, steam trap, strainer body and tank components in an air with borated water leakage environment only. The GALL Report recommends GALL AMP XI.M18, “Bolting Integrity,” to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant’s External Surfaces Monitoring Program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff noted from its review that all but one AMR line item that the applicant referenced Item 3.2.1-23 and Item 3.3.1-43 and credited the External Surfaces Monitoring Program are not bolting components with an intended function for mechanical closure. The staff further noted that the applicant referenced Item 3.2.1-23 of LRA Table 3.2.1 and Item 3.3.1-43 of LRA Table 3.3.1 because there was not another applicable Table 1 line item in LRA Table 3.2.1 and LRA Table 3.3.1 that corresponded to the same material, environment and aging effect combination. The staff confirmed that for the one AMR line item in this review that a bolting component with an intended function for mechanical closure was listed, the applicant also credited the Bolting Integrity Program, which is recommended by the GALL Report. The staff noted that the applicant was taken a conservative approach by crediting the GALL recommended program, Bolting Integrity Program, and the External Surfaces Monitoring Program for periodic visual inspections of the components for this aging effect.

The staff determined that the External Surfaces Monitoring program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to general, pitting and crevice corrosion for steel components exposed to air with borated water leakage environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, and the applicant monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

Based on a review of the programs identified above, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.3 Loss Of Material Due To Pitting And Crevice Corrosion

LRA Table 3.3.1, Item 3.3.1-54 addresses loss of material due to pitting and crevice corrosion for stainless steel components with its internal surfaces exposed to wetted air/gas in the emergency diesel generators and auxiliary systems, miscellaneous floor and equipment drains system and the radwaste system.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, to manage this aging effect for stainless steel piping, fittings, pump casings, tanks and valve body components in a wetted air/gas environment only. The GALL Report recommends GALL AMP XI.M24, "Compressed Air Monitoring," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff noted that the wetted air/gas environment is not the same as a compressed air environment for which GALL AMP XI.M24 is intended to manage, and thus cannot be used for aging management. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which include periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel components exposed to wetted air/gas (internal) addressed by this AMR. On the basis of periodic visual inspections, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

In LRA Table 3.3.2-10, the applicant stated that loss of material due to pitting and crevice corrosion of stainless steel sprinkler heads exposed to wetted air in the fire protection system is managed by the Fire Water System Program.

The staff noted that the applicant applied note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-54 and GALL Report Volume 2, item VII.D-4. The staff reviewed the AMR results lines that reference Generic Note E and finds that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M24, "Compressed Air Monitoring," the applicant proposed using the Fire Water System Program. The staff noted that these components are in the fire protection system and therefore, will not be in the scope of the Compressed Air Monitoring Program.

The staff reviewed the Fire Water System program, which manages aging effect of loss of material for the water-based fire protection system and associated components, through the use of periodic inspections, monitoring, and performance testing, and is consistent with the GALL AMP XI.M27, Fire Water System. As recommended by the GALL AMP XI.M27, the applicant has committed to testing or replacement of sprinkler heads in service for 50 years. The staff’s review of the Fire Water System program and its evaluation is documented in SER Section 3.0.3.2.10. On the basis that periodic inspections, monitoring and performance testing will be performed, the staff finds that the Fire Water System program will adequately manage loss of material due to pitting and crevice corrosion of stainless steel sprinkler heads exposed to wetted air in the fire protection system through the period of extended operation.

In LRA Table 3.3.2-10, the applicant stated that loss of material due to pitting and crevice corrosion of stainless steel spray nozzles exposed to wetted air in the fire protection system is managed by the Fire Protection Program. The staff noted that the applicant applied note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-54 and GALL Report Volume 2, item VII.D-4. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M24, "Compressed Air Monitoring," the applicant proposed using the Fire Protection program. The staff noted that these components are in the fire protection system and therefore, will not be in the scope of the Compressed Air Monitoring Program.

The staff reviewed the Fire Protection program, which includes monitoring, testing, and inspection activities including low-pressure carbon dioxide fire suppression system flow testing to verify flow from each nozzle. The staff also noted that that any adverse conditions such as excessive dirt or debris, or other degrading condition are required to be reported for corrective action evaluation. The staff's review of the Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.9. On the basis that monitoring and testing on a periodic interval will be performed, the staff finds that the Fire Protection Program will adequately manage loss of material due to pitting and crevice corrosion of stainless steel spray nozzles exposed to wetted air in the fire protection system through the period of extended operation.

LRA Table 3.3.1, line item 3.3.1-54 addresses loss of material due to pitting and crevice corrosion for stainless steel components with their internal surfaces exposed to wetted air/gas in the condensers & air removal system. The staff noted that the applicant referenced line item 3.3.1-54 of LRA Table 3.3.1 because there was not an applicable Table 1 line item in LRA Table 3.4.1 that corresponded to the same material, environment and aging effect combination.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, to manage this aging effect for stainless steel thermowells and valve body components in a wetted air/gas environment only. The GALL Report recommends GALL AMP XI.M24, "Compressed Air Monitoring," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff noted that the wetted air/gas environment is not the same as a compressed air environment for which GALL AMP XI.M24 is intended to manage, and thus GALL AMP XI.M24 cannot be used for aging management. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel components exposed to wetted air/gas (internal) addressed by this AMR. On the basis of periodic visual inspections, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

LRA Table 3.5.1, Items 3.5.1-47 and 3.5.1-50, address loss of material due to pitting and crevice corrosion for copper alloys (with 15% zinc or more and with less than 15% zinc) and stainless steel components, respectively, with their external surfaces exposed to outdoor air in the fire protection system and the auxiliary and fuel handling building ventilation system. The staff noted that the applicant referenced Item 3.5.1-47 and Item 3.5.1-50 of LRA Table 3.5.1 because there was not an applicable Table 1 line item in LRA Table 3.3.1 that corresponded to the same material, environment and aging effect combination.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for coppery alloys (with 15% zinc or more and with less than 15% zinc) sprinkler and valve body components and stainless piping, fittings, valve body, sprinkler and spray nozzle components in an outdoor air (external) environment only. The GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the External Surfaces Monitoring Program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to pitting and crevice corrosion for copper alloys (with 15% zinc or more and with less than 15% zinc) and stainless steel components exposed to outdoor air (external) addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

Based on a review of the programs identified, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.4 Loss Of Material Due To General Corrosion

In LRA Table 3.3.2-10, the applicant stated that loss of material due to general corrosion of fire protection system steel fire barrier doors and penetration seals in an external environment of air-indoor is managed by the Fire Protection Program.

The staff noted that the applicant applied note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-58 and GALL Report Volume 2, item VII.I-8. The staff reviewed the AMR results lines that reference Generic Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M36, "External Surface Monitoring," the applicant proposed using the Fire Protection Program.

GALL AMP XI.M36 recommends periodic visual inspection of the external surface of components. The staff reviewed the Fire Protection Program, which provides for periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings and floors; and fire doors for managing loss of material due to corrosion and finds that it is consistent with GALL AMP XI.M26, “Fire Protection.” The staff’s review of the Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.9. On the basis that periodic visual inspection is performed, the staff finds that the Fire Protection Program will adequately manage loss of material due to general corrosion of fire protection system steel fire barrier doors and penetration seals in an external environment of air-indoor.

Based on a review of the program identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.5 Loss Of Material Due To General, Pitting, And Crevice Corrosion

In LRA Table 3.3.2-10, the applicant stated that loss of material due to general, pitting and crevice corrosion of fire protection system steel fire barrier doors exposed to outdoor air environment is managed by the Fire Protection Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-60 and GALL Report Volume 2, item VII.H1-8. The staff reviewed the AMR results lines that reference note E and finds that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M36, "External Surface Monitoring," the applicant proposed using the Fire Protection Program.

GALL AMP XI.M36 recommends periodic visual inspection of the external surface of components. The staff reviewed the Fire Protection Program, which provides for periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings and floors; and fire doors for managing loss of material due to corrosion and finds that it is consistent with GALL AMP XI.M26, "Fire Protection." The staff's review of the Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.9. On the basis that periodic visual inspection is performed, the staff finds that the Fire protection Program will adequately manage loss of material due to general, pitting and crevice corrosion of fire protection system steel fire barrier doors in an outdoor air environment during the period of extended operation.

Based on a review of the program identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.6 Loss Of Material Due To Pitting And Crevice Corrosion

In LRA Table 3.3.2-10, the applicant stated that loss of material due to pitting and crevice corrosion of aluminum piping components exposed to raw water in the fire protection system is managed by the Fire Water System Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-62 and GALL Report Volume 2, item VII.G-8. The staff reviewed the AMR results lines that reference Generic Note E and finds that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M26, "Fire Protection," the applicant proposed using the Fire Water System Program. The staff noted that these components are in water-based fire protection system and therefore are not in the scope of the Fire Protection Program.

The staff reviewed the Fire Water System Program, which manages identified aging effects for the water-based fire protection system and associated components, through the use of periodic inspections, monitoring, and performance testing, and finds that it is consistent with the GALL AMP XI.M27, “Fire Water System.” The staff’s review of the Fire Water System Program and its evaluation is documented in SER Section 3.0.3.2.10. On the basis that periodic inspections, monitoring and performance testing will be performed, the staff finds that the Fire Water System Program will adequately manage loss of material due to pitting and crevice corrosion of aluminum piping components exposed to raw water in the fire protection system through the period of extended operation.

Based on a review of the program identified above, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.7 Loss Of Material Due To General, Pitting, Crevice, And Microbiologically-influenced Corrosion, And Fouling

LRA Table 3.3.1, Item 3.3.1-68 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling for steel components with its external and internal surfaces exposed to raw water in the Miscellaneous Floor and Equipment Drains System and the Closed Cycle Cooling Water System.

The LRA credits the AMP B.2.1.22, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” to manage this aging effect for steel flow devices, heat exchanger components, pump casings, spectacle blinds, strainer body, piping, fittings, tanks and valve body components in a raw water (internal) environment only. The LRA credits the AMP B.2.1.21 “External Surfaces Monitoring” to manage this aging effect for steel pump casings components in a raw water (external) environment only. The GALL Report recommends GALL AMP XI.M27, "Fire Water System," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff confirmed that only piping, piping components and piping elements align to GALL Item VII.G-24 and are fabricated from steel materials that are applicable to TMI.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and External Surfaces Monitoring program and its evaluations are documented in SER Sections 3.0.3.2.16 and 3.0.3.2.17, respectively. The staff noted that the program that is recommended by the GALL Report was meant to specifically address this aging effect for Fire Protection Systems that are tested in accordance with NFPA codes and standards. However, the staff further noted that the applicant referenced Item 3.3.1-68 of LRA Table 3.3.1 because there was not another applicable Table 1 line item in LRA Table 3.3.1 that corresponded to the same material, environment and aging effect combination. The systems in which the applicant’s AMR Line items that are discussed in this section are not Fire Protection Systems; they are the Miscellaneous Floor and Equipment Drains System and the Closed Cycle Cooling Water System.

The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling for steel components exposed to raw water (internal) addressed by this AMR. The staff determined that the External Surfaces Monitoring program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling for steel components exposed to raw water (internal) addressed by this AMR.

On the basis of periodic visual inspections and volumetric testing, when appropriate, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable. On the basis of periodic visual inspections, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

Based on a review of the programs identified, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.8 Loss Of Material Due To General, Pitting, And Crevice Corrosion

In LRA Table 3.3.2-10, the applicant stated that loss of material due to general, pitting and crevice corrosion of fire protection system steel spray nozzles exposed to air-gas wetted internal environment is managed by the Fire Protection Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-71 and GALL Report Volume 2, item VII.G-23. The staff reviewed the AMR results lines that reference Generic Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed using the Fire Protection Program.

GALL AMP XI.M38 recommends periodic visual inspection of the internal surface of components when accessible during performance of maintenance or surveillance activities. The staff noted that these spray nozzles are in the halon and carbon dioxide fire protection system. The staff reviewed the Fire Protection Program, which provides for periodic visual inspection and performance testing of halon and carbon dioxide system components, including spray nozzles, which are open to atmosphere, for managing loss of material due to corrosion and finds that it is consistent with GALL AMP XI.M26, “Fire Protection.” The staff’s review of the Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.9. On the basis that periodic visual inspection is performed, the staff finds that the Fire protection Program will adequately manage loss of material due to general, pitting and crevice corrosion of fire protection system steel spray nozzles exposed to air-gas wetted internal environment during the period of extended operation.

In LRA Table 3.3.2-14, the applicant stated that loss of material due to general, pitting and crevice corrosion of instrument and control air system steel piping and fittings, heat exchanger components, filter housing, pump casing, tanks and valve bodies exposed to air/gas wetted internal environment is managed by the Compressed Air Monitoring Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-71 and GALL Report Volume 2, item VII.G-23. The staff reviewed the AMR results lines that reference Generic Note E and finds that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed using the Compressed Air Monitoring Program.

GALL AMP XI.M38 recommends periodic visual inspection of the internal surface of components when accessible during performance of maintenance or surveillance activities. Since these components are in the instrument and control air system, the applicant has proposed the Compressed Air Monitoring Program. The staff reviewed the Compressed Air Monitoring Program, which includes periodic visual inspection of internal surfaces of piping and heat exchanger components for loss of material and fouling, monitoring of system air quality in accordance with industry standards and guidelines, and finds that it is consistent with the GALL AMP XI.M24, “Compressed Air Monitoring.” The staff’s review of the Compressed Air Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.8. On the basis that periodic visual inspection of internal surfaces of piping and heat exchanger components is performed, the staff finds that the Compressed Air Monitoring program will adequately manage loss of material due to general, pitting and crevice corrosion of instrument and control air system steel piping and fittings, heat exchanger components, filter housing, pump casing, tanks and valve bodies exposed to air/gas wetted internal environment through the period of extended operation.

Based on a review of the programs identified above, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.9 Loss Of Material Due To General, Pitting, Crevice, And (For Drip Pans And Drain Lines) Microbiologically-influenced Corrosion

In LRA Table 3.3.2-14, the applicant stated that loss of material due to general, pitting, crevice and microbiologically-influenced corrosion of control building ventilation system steel air dryer exposed to air/gas wetted internal environment is managed by the Compressed Air Monitoring Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-72 and GALL Report Volume 2, item VII.F1-3. The staff reviewed the AMR results lines that reference Generic Note E and finds that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed using the Compressed Air Monitoring Program.

GALL AMP XI.M39 recommends periodic visual inspection of the internal surface of components when accessible during performance of maintenance or surveillance activities. Since the component is an air dryer, the applicant has proposed using the Compressed Air Monitoring Program. The staff reviewed the Compressed Air Monitoring Program, which includes periodic visual inspections of internal surfaces of piping and heat exchanger components for loss of material and fouling and monitoring of system air quality in accordance with industry standards and guidelines, and finds that it is consistent with the GALL AMP XI.M24, "Compressed Air Monitoring." The staff's review of the Compressed Air Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.8. On the basis that periodic visual inspection of internal surfaces of piping and heat exchanger components is performed, the staff finds that the Compressed Air Monitoring Program will adequately manage loss of material due to general, pitting, crevice and microbiologically-influenced corrosion of control building ventilation system steel air dryer exposed to air/gas wetted internal environment through the period of extended operation.

Based on a review of the program identified above, the staff determines that the applicant's proposed program is acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.10 Loss Of Material Due To General, Pitting, Crevice, And Microbiologically-influenced Corrosion, Fouling, And Lining/Coating Degradation

LRA Table 3.3.1, Item 3.3.1-76 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling for steel components with their internal surfaces exposed to raw water in the water treatment and distribution system.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, to manage this aging effect for steel piping, piping and flow components, pump casings, tanks and valve body components in a raw water (internal) environment only. The GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff confirmed that only piping, piping components and piping elements align to GALL Item VII.C1-19 and are fabricated from steel materials that are applicable to TMI.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling for steel components exposed to raw water (internal) addressed by this AMR. On the basis of periodic visual inspections, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.11 Loss Of Material Due To Pitting And Crevice Corrosion

LRA Table 3.3.1, Item 3.3.1-78 addresses loss of material due to pitting and crevice corrosion for stainless steel and nickel alloy components with internal surfaces exposed to raw water in the miscellaneous floor and equipment drains system and radwaste system.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, to manage this aging effect for nickel alloy and stainless steel piping, fittings and various floor sump tank components in an internal raw water environment only. The GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff noted that these AMR Line items in the reactor building sump and drain system are not in the scope of an open-cycle cooling water system as described in GL 89-13, and therefore is not within the scope of GALL AMP XI.M20, "Open-Cycle Cooling Water System."

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel and nickel alloy components exposed to raw water environment (internal) addressed by this AMR. On the basis of periodic visual inspections, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.12 Loss Of Material Due To Pitting, Crevice, And Microbiologically-influenced Corrosion

In LRA Table 3.3.2-10, the applicant stated that loss of material due to pitting, crevice, and microbiologically-influenced corrosion of fire protection system stainless steel piping, flow elements, restricting orifices, sprinkler heads, strainer element and valve body in an internal environment of raw water is managed by the Fire Water System Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-80 and GALL Report Volume 2, item VII.H2-18. The staff reviewed the AMR results lines that reference Generic Note E and finds that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Fire Water System program. The staff noted that these components are in the fire protection system and will not be in the scope of the GL 89-13 program as dictated by the Open-Cycle Cooling Water Program.

GALL AMP XI.M20, "Open-Cycle Cooling Water System" recommends performance testing and inspection to manage the effects of loss of material. The staff reviewed the Fire Water System Program, which manages identified aging effects for the water-based fire protection system and associated components, through the use of periodic inspections, monitoring, and performance testing and provides for preventive measures and inspection activities to detect aging effects prior to loss of intended functions, and finds that it is consistent with the GALL AMP XI.M27, “Fire Water System.” The staff’s review of the Fire Water System Program and its evaluation is documented in SER Section 3.0.3.2.10. On the basis that periodic inspection, monitoring and performance testing will be performed, the staff finds that the Fire Water System Program will adequately manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion of stainless steel piping, flow elements, restricting orifices, sprinkler heads, strainer element and valve body in an internal environment of raw water in the fire protection system through the period of extended operation.

Based on a review of the programs identified, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.13 Loss Of Material Due To Pitting, Crevice, And Microbiologically-influenced Corrosion, And Fouling

LRA Table 3.3.1, Item 3.3.1-81 addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling for copper alloy (with 15% zinc or more and with less than 15% zinc) components with its internal surfaces exposed to raw water in the miscellaneous floor and equipment drains system and the water treatment and distribution system.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, to manage this aging effect for copper alloy (with 15% zinc or more and with less than 15% zinc) piping, fittings, tanks and valve body components in a raw water (internal) environment only. The GALL Report recommends GALL AMP XI.M20, “Open-Cycle Cooling Water System,” to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff confirmed that only piping, piping components and piping elements align to GALL Item VII.C1-9 and are fabricated from copper alloy materials that are applicable to TMI.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which includes periodic visual inspections and volumetric testing, when appropriate, during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections, is adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling for copper alloy (with 15% zinc or more and with less than 15% zinc) components exposed to raw water (internal) addressed by this AMR. On the basis of periodic visual inspections and volumetric testing, when appropriate, the staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.14 Loss Of Material Due To General, Pitting, And Crevice Corrosion

In LRA Table 3.3.2-10, the applicant stated that loss of material due to general, pitting and crevice corrosion of fire protection system steel fire barrier doors and penetration seals exposed to air with borated water leakage external environment are managed by the Fire Protection Program.

The staff noted that the applicant applied Generic Note E to this item. The applicant referenced LRA Table 3.3-1, item 3.3.1-86 and GALL Report Volume 2, item VII.A1-1. The staff reviewed the AMR results lines that reference Generic Note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.S6, "Structures Monitoring Program," the applicant proposed using the Fire Protection Program.

In RAI 3.3.2-10-1, dated October 16, 2008, the staff requested that the applicant provide additional information to explain why GALL Report item VII.A1-1 was used, since this item is for steel components in an air-indoor environment, and not an air with borated water leakage environment. The staff noted that the applicant referenced GALL Report item III.B5-8 for fire doors in LRA Tables 3.5.2-2 and 3.5.2-7. The staff also asked the applicant to justify why it used the Fire Protection Program and not the Boric Acid Corrosion Program, and which program will be used to evaluate and control boric acid leakage.

In its response to the RAI dated November 12, 2008, the applicant stated that in its aging management review process, for steel components in air with borated water leakage environment, it considered loss of material due to boric acid leakage, and due to general, pitting and crevice corrosion. The applicant also mentioned that GALL Report item VII.A1-1 was referenced for loss of material due to general, pitting and crevice corrosion, and item VII.I-10 was referenced for loss of material due to boric acid leakage because the fire protection system is included in GALL Report Chapter VII, Auxiliary Systems and not in Chapter III, which is for structures.

The applicant further stated that both the Fire Protection Program and the Boric Acid Corrosion Program are credited in the LRA. The Fire Protection Program is credited for managing loss of material due to general, pitting and crevice corrosion, whereas the Boric Acid Corrosion Program is credited for managing loss of material due to boric acid leakage. In all cases, the applicant stated, the Boric Acid Corrosion Program is used to evaluate and control boric acid leakage.

Based on its review, the staff finds the applicant's response to the RAI acceptable because the applicant has credited the Boric Acid Corrosion Program to manage loss of material due to boric acid leakage and is using the Fire Protection Program to manage loss of material due to general, pitting and crevice corrosion. Furthermore, the staff finds the use of GALL Report item VII.A1-1 to be acceptable since the fire protection system is part of the GALL Report Chapter VII, Auxiliary Systems. The staff reviewed the Fire Protection Program, which provides for periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings and floors; and fire doors for managing loss of material due to corrosion and is consistent with GALL AMP XI.M26, "Fire Protection." The staff's review of the Fire Protection program and its evaluation is documented in SER Section 3.0.3.2.9. On the basis that periodic visual inspection is performed, the staff finds that the Fire Protection Program will adequately manage loss of material due to general, pitting and crevice corrosion of fire protection system steel fire barrier doors and penetration seals exposed to air with borated water leakage external environment during the period of extended operation.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.15 Loss of Material due to General, Pitting, Crevice, and Galvanic Corrosion

In LRA Table 3.3.1, item 3.3.1-48, the applicant stated that the AMR result is not consistent with the GALL Report. LRA Tables 3.3.2-9 and 3.3.2-22 include AMR result lines referencing item 3.3.1-48 where carbon steel components in a closed-cycle cooling water environment have an aging effect of loss of material due to general, pitting and crevice corrosion and the recommended AMP is the Closed-Cycle Cooling Water System program. For these AMR result lines the applicant cited generic note I, indicating that the aging effect in the GALL Report for the component, material and environment combination is not applicable. The applicant also included a plant-specific note stating that loss of material due to galvanic corrosion is not predicted because materials that cause galvanic corrosion are not in contact with the component.

The staff noted that the applicant appeared to be citing Generic Note I to indicate that the aging effect due to one mechanism, galvanic corrosion, is not present, rather than to indicate that the aging effect is not present at all. In RAI 3.3.2-48-1, dated October 16, 2008, the staff requested that the applicant provide additional information to clarify the meaning of Generic Note I, as used for these AMR result lines.

In its response to the RAI dated November 12, 2008, the applicant stated that Generic Note I in the LRA 3.x.2 AMR tables is applied when the component, material and environment combination exists but the aging effect, or any of the identified aging mechanisms associated with the aging effect, in the GALL Report is not predicted. The applicant stated that in these cases, the GALL Report Table 1 item number is identified in the LRA 3.x.1 aging management summary tables as being applicable and the specific aging effect/mechanism that is not predicted is identified in the item discussion column or in the evaluation paragraph where the GALL Report specifies further evaluation. The applicant further stated that in accordance with EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guidelines and Mechanical Tools," Revision 4, galvanic corrosion is not predicted for component, material, and environment combinations when the material subject to AMR is not in contact with a material of different electrochemical potential, and that in these cases the Table 3.x.2 AMR line items are identified with generic note I.

Because the applicant cited Generic Note I for AMR results where one aging mechanism, rather than the aging effect due to all mechanisms, does not occur, the staff finds that the applicant's use of generic note I does not indicate an inconsistency with comparable AMR results in the GALL Report. Because the component, material, environment and aging effect combination (except for one aging mechanism) is consistent with the GALL Report and the AMP proposed by the applicant is the same as the AMP recommended in the GALL Report, the staff finds that the applicant's AMR results are consistent with the GALL Report and are acceptable.

Based on its review, the staff finds the applicant's response to RAI 3.3.2-48-1 acceptable because the applicant's use of Generic Note I does not indicate an inconsistency with comparable AMR results in the GALL Report. The staff also finds that because the component, material, environment and aging effect combination (except for one aging mechanism) is consistent with the GALL Report, and the AMP proposed by the applicant is the same as the AMP recommended in the GALL Report, the AMR results are consistent with the GALL Report. The staff's concern described in RAI 3.3.2-48-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.16 Loss of Material due to Pitting, Crevice, and Galvanic Corrosion

In LRA Table 3.3.1, item 3.3.1-51, the applicant stated that the AMR result is not consistent with the GALL Report. LRA Tables 3.3.2-4, 3.3.2-6, 3.3.1-9, 3.3.2-22 and 3.3.2-24 include AMR results referencing item 3.3.1-51 where copper alloy components in a closed-cycle cooling water environment have an aging effect of loss of material due to pitting and crevice corrosion and the recommended AMP is the Closed-Cycle Cooling Water System program. For these AMR results the applicant cited generic note I, indicating that the aging effect in the GALL Report for the component, material and environment combination is not applicable. The applicant also included a plant-specific note stating that loss of material due to galvanic corrosion is not predicted because materials that cause galvanic corrosion are not in contact with the component.

The staff noted that the applicant appeared to be citing note I to indicate that the aging effect due to one mechanism, galvanic corrosion, is not present, rather than to indicate that the aging effect is not present at all. In a letter dated October 16, 2008, the staff issued RAI 3.3.1-48-1 and requested that the applicant provide additional information to clarify the meaning of generic note I, as used for these AMR result lines.

In its response to the RAI dated November 12, 2008, the applicant stated that generic note I in the LRA 3.x.2 AMR tables is applied when the component, material and environment combination exists but the aging effect, or any of the identified aging mechanisms associated with the aging effect in the GALL Report is not predicted. The applicant stated that in these cases, the GALL Report Table 1 item number is identified in the LRA 3.x.1 aging management summary tables as being applicable and the specific aging effect/mechanism that is not predicted is identified in the item discussion column or in the evaluation paragraph where the GALL Report specifies further evaluation. The applicant further stated that in accordance with EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guidelines and Mechanical Tools," Revision 4, galvanic corrosion is not predicted for component, material, and environment combinations when the material subject to AMR is not in contact with a material of different electrochemical potential, and that in these cases the Table 3.x.2 AMR line items are identified with generic note I.

Based on its review, the staff finds the applicant's response to RAI 3.3.1-48-1 acceptable because the applicant cited generic note I for AMR results where one aging mechanism, rather than the aging effect due to all mechanisms, does not occur which does not indicate an inconsistency with comparable AMR results in the GALL Report. Because the component, material, environment and aging effect combination (except for one aging mechanism) is consistent with the GALL Report and the AMP proposed by the applicant is the same as the AMP recommended in the GALL Report, the staff finds that the applicant's AMR results are consistent with the GALL Report and are acceptable. The staff's concern in RAI 3.3.1-48-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.17 Loss of Material due to General, Pitting, Crevice, and Microbiologically-influenced Corrosion, Fouling, and Lining/Coat Degradation

LRA Table 3.3.2-25 includes AMR results for carbon steel, ductile cast iron and gray cast iron components in a raw water environment in the water treatment and distribution system where the aging effect of loss of material is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP. For these AMR results, the applicant referred to LRA Table 3.3.1, item 3.3.1-76, where the AMP recommended by the GALL Report is the Open-Cycle Cooling Water System program, and cited generic note E indicating that the result is consistent with the GALL Report for material, environment and aging effect, but a different aging management program is used.

In a letter dated October 16, 2008, the staff issued RAI 3.3.2-25-1 requesting that the applicant provide additional information to explain why an AMP different from the one recommended in the GALL Report is being used for these components.

In its response to the RAI dated November 12, 2008, the applicant stated that the raw water environment in the water treatment and distribution system includes domestic water, filtered water, and other non-demineralized water sources. The applicant stated that these environments are not considered raw cooling water and, as such, are not addressed by the activities of the Open-Cycle Cooling Water System AMP. The applicant further stated that these environments are not addressed by the activities of the Water Chemistry AMP.

The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components AMP includes internal inspections that are performed during periodic system and component inspections and during the performance of maintenance activities when the surfaces are made accessible for inspection. The applicant stated that the program includes visual inspections to assure that environmental conditions are not resulting in material degradation such as loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling and that material degradation identified during the inspections will be entered into the corrective action process for further evaluation.

The staff reviewed the applicant's RAI response and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.17, determined that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, with an acceptable exception, is consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," and provides for visual inspections of internal surfaces of plant components to be performed during maintenance or surveillance activities, including visible evidence of corrosion to indicate possible loss of materials. The staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program includes evaluation of indications of corrosion or fouling to determine whether component intended function is affected and requires corrective actions in accordance with the site's corrective action program and quality assurance procedures. The staff's concern in RAI 3.3.2-25-1 is resolved.

Based on its review, the staff finds the applicant's response to RAI 3.3.2-25-1 acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program includes detection of loss of material and requires appropriate corrective actions if loss of material affecting component intended function is found. The staff finds that the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage loss of material in carbon steel, ductile cast iron and gray cast iron components in a raw water environment in the water treatment and distribution system to be acceptable. The staff's concern described in RAI 3.3.2-25-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.18 Loss of Material due to Pitting, Crevice, Galvanic and Microbiologically-influenced Corrosion and Fouling

In LRA Table 3.3.1, Item 3.3.1-82, the applicant stated that the AMR result is not consistent with the GALL Report. LRA Table 3.2.2-4 includes AMR result lines referring to Table 3.3.1, Item 3.3.1-82, where the copper alloy components in a raw water environment have an aging effect of loss of material due to pitting, crevice and microbiologically-influenced corrosion and fouling and the recommended AMP is the Open-Cycle Cooling Water System program. For these AMR result lines the applicant cited generic Note I, indicating that the aging effect in the GALL Report for the component, material and environment combination is not applicable. The applicant also included a plant-specific note stating that the aging mechanism of galvanic corrosion does not apply since the material is not in contact with material higher in galvanic series.

The staff noted that the applicant appeared to be citing note I to indicate that the aging effect due to one mechanism, galvanic corrosion, is not present, rather than to indicate that the aging effect is not present at all. In a letter dated October 16, 2008, the staff issued RAI 3.3.1-48-1 requesting that the applicant provide additional information to clarify the meaning of generic note I, as used for these AMR result lines.

In its response to the RAI dated November 12, 2008 the applicant stated that generic note I in the LRA 3.x.2 AMR tables is applied when the component, material and environment combination exists but the aging effect, or any of the identified aging mechanisms associated with the aging effect, in the GALL Report is not predicted. The applicant stated that in these cases, the GALL Report Table 1 item number is identified in the LRA 3.x.1 aging management summary tables as being applicable and the specific aging effect/mechanism that is not predicted is identified in the item discussion column or in the evaluation paragraph where the GALL Report specifies further evaluation. The applicant further stated that in accordance with EPRI Report 1010639, “Non-Class 1 Mechanical Implementation Guidelines and Mechanical Tools,” Revision 4, galvanic corrosion is not predicted for component, material, and environment combinations when the material subject to AMR is not in contact with a material of different electrochemical potential, and that in these cases the Table 3.x.2 AMR line items are identified with generic note I.

Based on its review, the staff finds the applicant’s response to the RAI acceptable because the applicant cited generic note I for AMR results where one aging mechanism, rather than the aging effect due to all mechanisms, does not occur, which does not indicate an inconsistency with comparable AMR results in the GALL Report. Because the component, material, environment and aging effect combination (except for one aging mechanism) is consistent with the GALL Report and the AMP proposed by the applicant is the same as the AMP recommended in the GALL Report, the staff finds that the applicant’s AMR results are consistent with the GALL Report and are acceptable. The staff’s concern described in RAI 3.3.1-48-1 is resolved.

Based on the programs identified, the staff concludes that the applicant’s proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.19 Cracking due to Stress Corrosion Cracking, or Loss of Material due to Pitting and Crevice Corrosion

LRA Table 3.2.2-21 includes AMR result lines referring to Table 3.3.1, Items 3.3.1-90 or 3.3.1-91, for stainless steel components in a treated borated water environment in the radwaste system having aging effects of cracking due to stress corrosion cracking or loss of material due to pitting and crevice corrosion. For these components the applicant credited the One-Time Inspection program in addition to the Water Chemistry program for managing the aging effects in the components. For the AMR result lines using the One-Time Inspection Program, the applicant cited generic note E, indicating that the result line is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The applicant also cited a plant-specific note stating that for portions of the radwaste system which receive drainage of reactor and spent fuel pool grade borated treated water, plant operating experience is that aging effects progress very slowly but local environments may be more adverse than the general environment; the applicant states that the One-Time Inspection program will augment the Water Chemistry program by verifying the absence of aging effects.

The staff reviewed the applicant’s One-Time Inspection program. The staff’s evaluation of this program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection program is consistent with GALL AMP XI.M32, “One-Time Inspection,” and is adequate to detect the presence or note the absence of cracking due to SCC or of loss of material due to pitting and crevice corrosion. Because the One-Time Inspection program is used as an augmentation of the AMP recommended in the GALL report and provides added assurance that the aging effects are not present or are progressing slowly, the staff finds the AMPs specified by the applicant for these AMR result lines to be acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

LRA Section 3.3.2.2 provides further evaluation of aging management, as recommended by the GALL Report, for the auxiliary systems components. The applicant provided information concerning how it will manage the following aging effects:

- Cumulative Fatigue Damage
- Reduction of Heat Transfer Due to Fouling
- Cracking due to SCC
- Cracking due to SCC and Cyclic Loading
- Hardening and Loss of Strength due to Elastomer Degradation
- Reduction of Neutron-Absorbing Capacity and loss of material due to General Corrosion
- Loss of Material due to General, Pitting, and Crevice Corrosion
- Loss of Material due to General, Pitting, Crevice, and MIC
- Loss of Material due to general, Pitting, Crevice, MIC and Fouling
- Loss of Material due to Pitting and Crevice Corrosion
- Loss of Material due to Pitting, Crevice, and Galvanic Corrosion
- Loss of Material due to Pitting, Crevice, and MIC
- Loss of Material due to Wear
- Loss of Material due to Cladding Breach

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluations to determine whether they adequately address those issues. In addition, the staff reviewed the applicant's further evaluations against the criteria 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

Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either mechanical or thermal stresses. SRP-LR Section 3.3.2.2.1 states that fatigue is a TLAA as defined in 10 CFR 54.3 and that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis" or Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses" of the SRP-LR.

LRA Section 3.3.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c) and that the evaluations of this TLAA are addressed in Sections 4.3 and 4.6. This is consistent with SRP-LR Section 3.3.2.2.1 and is, therefore, acceptable.

3.3.2.2.2 Reduction of Heat Transfer due to Fouling

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

LRA Section 3.3.2.2.2 states that TMI-1 will implement a One-Time Inspection Program, to verify the effectiveness of the Water Chemistry Program, to manage the reduction of heat transfer due to fouling in stainless steel heat exchanger components exposed to treated water in the closed cycle cooling water system.

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2, which states that reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

SRP-LR Section 3.3.2.2.2 invokes AMR Item 3 in Table 3 of the GALL Report, Volume 1, and AMR Item VII.A4-4 in the GALL Report, Volume 2, as applicable to stainless steel heat exchanger tubes that are exposed to treated water.

The applicant stated that the Water Chemistry Program is consistent with EPRI 1002884, Pressurized Water Reactor Primary Chemistry Guidelines, Revision 5 and Plant Technical Specification limits for fluorides, chlorides, and dissolved oxygen and is consistent with GALL Report AMP XI.M2. The applicant also stated that the One-Time Inspection Program will be used to confirm the effectiveness of the Water Chemistry Program to manage the loss of material, cracking, and the reduction of heat transfer aging effects and is consistent with GALL Report AMP XI.M32. The staff's review of the Water Chemistry program and the One-Time Inspection program and its evaluation is documented in SER Sections 3.0.3.2.2 and 3.0.3.2.14 respectively.

On the basis that the Water Chemistry Program maintains water chemistry within acceptable limits, and the One-Time Inspection Program performs visual inspection to confirm the effectiveness of the Water Chemistry Program, the staff finds that the Water Chemistry Program and the One-Time Inspection Program will adequately manage reduction of heat transfer due to fouling for stainless steel heat exchanger tubes exposed to treated water through the period of extended operation.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.2 criteria. For those line items that apply to LRA Section 3.3.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.3 Cracking due to SCC

The staff reviewed LRA Section 3.3.2.2.3 against the criteria in SRP-LR Section 3.3.2.2.3.

(1) LRA Section 3.3.2.2.3 addresses cracking due to SCC, stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.3.2.2.3 states that cracking due to SCC could occur in the stainless steel piping, piping components, and piping elements of the BWR standby liquid control system that are exposed to sodium pentaborate solution greater than 60 °C (140 °F).

This line item is not applicable to TMI-1 because TMI-1 is a PWR. On this basis, the staff finds that the SRP-LR criteria do not apply to TMI-1.

(2) LRA Section 3.3.2.2.3.2 refers to LRA Table 3.3.1, line item 5, and addresses cracking due to stress corrosion cracking in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60 °C (greater than 140 °F). The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

The staff reviewed LRA Section 3.3.2.2.3.2 against the criteria in SRP-LR Section 3.3.2.2.3.2, which states that cracking due to SCC could occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60 °C (greater than 140 °F). The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.3.2 invokes AMR Item 5 in Table 3 of the GALL Report, Volume 1, and AMR Items VII.E3-3 and VII.E3-19 in the GALL Report, Volume 2, as applicable to stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60 °C (greater than 140 °F).

In the applicant's response to RAI-AMR-GENERIC-2, the applicant stated that line item 3.3.1-5 is not applicable because this component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-14 from the steam and power conversion systems grouping and item 3.3.1-90. The applicant also stated that item 3.3.1-5 specifies a plant specific AMP which is satisfied by item 3.4.1-14, which specifies the Water Chemistry and One-Time Inspection AMPs. The applicant also stated that this combination is satisfied by item 3.3.1-90, which specifies the Water Chemistry AMP and that item 3.3.1-90 has been augmented in the aging management reviews to also include the One-Time Inspection AMP.

Based on its review of the LRA, the staff confirmed this component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-14 from the steam and power conversion systems grouping and also addressed by item 3.3.1-90. The staff also confirmed that item 3.3.1-5 specifies a plant specific AMP which is satisfied by item 3.4.1-14, which specifies the Water Chemistry and One-Time Inspection AMPs and by item 3.3.1-90, which specifies the Water Chemistry AMP. The staff confirmed that item 3.3.1-90 has been augmented in the aging management reviews to also include the One-Time Inspection AMP. The staff finds the applicant's determination acceptable.

(3) LRA Section 3.3.2.2.3 addresses cracking due to stress corrosion cracking in stainless steel diesel engine exhaust piping, piping components and piping elements exposed to

diesel exhaust. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage this aging effect in stainless steel internal surfaces exposed to diesel exhaust. The staff reviewed LRA Section 3.3.2.2.3 against the criteria in SRP-LR Section 3.3.2.2.3, which states that cracking due to stress corrosion cracking may occur in stainless steel diesel engine exhaust piping, piping component and piping elements exposed to diesel exhaust. The GALL Report, under Item VII.H2-1 recommends that a plant-specific program be credited to manage this aging effect for stainless steel piping, piping components and piping elements in the Auxiliary Systems.

The staff confirmed that only expansion joints that align to GALL AMRs VII.H2-1 for the Emergency Diesel Generators and Auxiliary System and the Station Blackout and UPS Diesel Generator System that are fabricated from stainless steel materials are applicable to TMI that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff noted that the applicant’s proposed program will supplement its period visual inspections with volumetric testing to specifically manage cracking due to stress corrosion cracking in stainless steel components for indications of degradation. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections and volumetric testing for stainless steel to detect cracking due to stress corrosion cracking that could result in a loss of the component's intended function. The staff further noted that volumetric testing to detect cracking due to stress corrosion cracking is consistent with the inspection techniques recommended by the GALL AMP XI.M32 “One-Time Inspection,” to detect the aging effect of cracking due to stress corrosion cracking. The staff finds that the applicant’s use of volumetric testing to be consistent with the inspection techniques recommended by the GALL Report to detect this aging effect. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage cracking due to stress corrosion cracking in stainless steel diesel exhaust piping, piping components and piping elements exposed to diesel exhaust on the internal surface.

Based on a review of the programs identified above, the staff concludes that the applicant’s program meets SRP-LR Section 3.3.2.2.3. For those line items that apply to LRA Section 3.3.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Cracking due to SCC and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4.

(1) LRA Section 3.3.2.2.4 refers to LRA Table 3.3.1, line item 7, and addresses cracking due to stress corrosion cracking and cyclic loading in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 60 °C (greater

than 140 °F) in the chemical and volume control system. The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4, which states that cracking due to SCC and cyclic loading may occur in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 140 °F in the CVCS. The existing AMP monitors and controls primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading; therefore, the effectiveness of water chemistry control programs should be verified to ensure that cracking does not occur. The GALL Report recommends that a plant-specific AMP be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are adequately managed. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water and eddy current testing of tubes.

SRP-LR Section 3.3.2.2.4.1 invokes AMR Item 7 in Table 3 of the GALL Report, Volume 1, and AMR Item VII.E1-9 in the GALL Report, Volume 2, as applicable to stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 140 °F.

In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, Item 3.3.1-7 is not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated that this line item is from GALL Section VII.E1 for PWR Chemical and Volume Control system stainless steel non-regenerative heat exchangers exposed to borated treated water environment greater than 140 °F. The applicant indicated that this GALL system has been included in the TMI-1 makeup and purification license renewal system. The applicant further stated that the subject heat exchangers are the letdown coolers and the RC pump seal coolers and the LRA treated water environment greater than 140 °F should have been applied to these components.

The applicant revised LRA Section 3.3.2.2.4.1 to state the following:

> TMI-1 will implement a One-Time Inspection program, B.2.1.18, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage cracking due to stress corrosion cracking in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 140 °F in the closed cycle cooling water system. Cracking due to cyclic loading does not apply since these components are continuously in service and not subject to cyclic loading. The GALL recommended verification program for temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes for managing cyclic loading is therefore not applicable. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

The applicant also revised the discussion column in LRA Table 3.3.1, line item 3.3.1-7 to state the following:

> Not consistent with NUREG-1801. The One-Time Inspection program, B.2.1.18, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to

manage cracking due to stress corrosion cracking in stainless steel nonregenerative heat exchanged components exposed to treated borated water greater than 60 °C (greater than 140 °F). Cracking due to cyclic loading does not apply since these components are continuously in service and not subject to cyclic loading.

The applicant included four additional line items in LRA Table 3.3.2-4, closed-cycle cooling water system to address these heat exchanger components as follows (columns 1 to 9, from left to right respectively):

(1) Heat exchange components (letdown Coolers); Pressure Boundary; Stainless Steel; Treated Water (Internal) greater than 140 °F; Cracking/Stress Corrosion Cracking; One-Time Inspection (B.2.1.18); VII.E1-9; 3.3.1-7; and, I, 5.

(2) Heat exchange components (letdown Coolers); Pressure Boundary; Stainless Steel; Treated Water (Internal) greater than 140 °F; Cracking/Stress Corrosion Cracking; Water Chemistry (B.2.1.2); VII.E1-9; 3.3.1-7; and, I, 5.

(3) Heat exchange components (RC Pump Seal Return Coolers); Pressure Boundary; Stainless Steel; Treated Water (Internal) greater than 140 °F; Cracking/Stress Corrosion Cracking; One-Time Inspection (B.2.1.18); VII.E1-9; 3.3.1-7; and, I, 5.

(4) Heat exchange components (RC Pump Seal Return Coolers); Pressure Boundary; Stainless Steel; Treated Water (Internal) greater than 140 °F; Cracking/Stress Corrosion Cracking; Water Chemistry (B.2.1.2); VII.E1-9; 3.3.1-7; and, I, 5.

The staff reviewed the Water Chemistry Program, which is consistent with GALL AMP XI.M2, "Water Chemistry," and is also consistent with EPRI 1002884, "Pressurized Water Reactor Primary Chemistry Guidelines," Revision 5 and Plant TS limits for fluorides, chlorides, and dissolved oxygen. The staff also reviewed the One-Time Inspection Program, which is consistent with GALL AMP XI.M32, "One-Time Inspection," and uses enhanced VT-3 as recommended by GALL AMP XI.M32 to detect cracking. The staff's evaluation is of the Water Chemistry Program and the One-Time Inspection Program is documented in SER Sections 3.0.3.2.2 and 3.0.3.2.14 respectively. The staff determined that since these components are in continuous service and not subject to cyclic loading, cracking due to cyclic loading is not an applicable aging effect for these components.

The staff noted that GALL Report item V.D1-31 in PWR emergency core cooling system recommends Water Chemistry Program by itself to manage the aging effect of cracking due to stress corrosion cracking for stainless steel piping, piping components, and piping elements in an environment of treated borated water greater than 140 °F. The applicant is proposing the use of the One-Time Inspection program to verify the effectiveness of the Water Chemistry program. Therefore, on the basis that the applicant is verifying the effectiveness of the Water Chemistry Program, which beyond the recommendations of the GALL Report to use only the Water Chemistry program, the staff finds the combination of Water Chemistry program and the One-Time Inspection program will adequately manage the aging effects of cracking due to stress corrosion cracking in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 140 °F in the chemical and volume control system.

(2) LRA Section 3.3.2.2.4 refers to LRA Table 3.3.1, line item 8, and addresses cracking due to stress corrosion cracking and cyclic loading in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 60 °C (greater than 140 °F). The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

SRP-LR Section 3.3.2.2.4 states that cracking due to SCC and cyclic loading may occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60 °C (140 °F).

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4, which states that cracking due to SCC and cyclic loading may occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 140 °F. The existing AMP monitors and controls primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading; therefore, the effectiveness of water chemistry control programs should be verified to ensure that cracking does not occur. The GALL Report recommends that a plant-specific AMP be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.4 invokes AMR Item 8 in Table 3 of the GALL Report, Volume 1, and AMR Item VII.E1-5 in the GALL Report, Volume 2, as applicable to stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 140 °F.

In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, line item 3.3.1-8 is not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated there are no stainless steel regenerative heat exchanger components exposed to treated borated water greater than 60 °C (greater than 140 °F) in auxiliary systems and that the TMI-1 design does not include regenerative heat exchangers. Based on its review of the LRA, the staff confirmed that there are no stainless steel regenerative heat exchanger components exposed to treated borated water greater than 60 °C (greater than 140 °F) in auxiliary systems and that the TMI-1 design does not include regenerative heat exchangers. The staff finds the applicant’s determination acceptable.

(3) LRA Section 3.3.2.2.4 refers to LRA Table 3.3.1, line item 9, and addresses cracking due to stress corrosion cracking and cyclic loading in stainless steel pump casings for the PWR high pressure pumps in the chemical and volume control system. The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

SRP-LR Section 3.3.2.2.4 states that cracking due to SCC and cyclic loading may occur in the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system.

In RAI AMR-GENERIC-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, line item 3.3.1-9 is not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated that this particular component, material, environment, and aging effect/mechanism combination does not exist. The applicant also stated that this line item is from GALL Section VII.E1 for PWR Chemical and Volume Control System stainless steel high pressure pumps and that this GALL system has been included in the TMI-1 makeup and purification (MUP) license renewal system. The applicant also stated that the subject pumps are the MU-P-1A/B/C make-up and purification pumps and that the components are not subject to a treated water environment greater than 140 °F so cracking due to SSC does not apply. The applicant also stated that cracking due to cyclic loading does not apply since these components are continuously in service and not subject to cyclic loading. Based on its review of the LRA, the staff confirmed that this GALL system has been included in the TMI-1 makeup and purification license renewal system. The staff also confirmed that the subject pumps are the MU-P-1A/B/C make-up and purification pumps and that the components are not subject to a treated water environment greater than 140 °F. The staff also confirmed that that cracking due to cyclic loading does not apply since these components are continuously in service and not subject to cyclic loading. The staff finds the applicant’s determination acceptable.

(4) LRA Section 3.3.2.2.4 refers to LRA Table 3.3.1, line item 10, and addresses cracking due to stress corrosion cracking and cyclic loading in high strength steel closure bolting exposed to air with steam or water leakage. The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

The applicant manages the cracking of high strength bolting with the Bolting Integrity Program which is discussed in SER Section 3.0.3.1.3. The applicant’s Bolting Integrity Program follows the guidelines of EPRI NP-5769, “Degradation and Failure of Bolting in Nuclear Power Plants,” in its selection of bolting material and the use of lubricants and sealants. Additionally, the program follows the guidelines of NUREG-1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," to prevent or mitigate degradation and failure of safety-related bolting, including the verification of gasket compression, and application of an appropriate preload. The staff finds this acceptable because it is in agreement with the GALL recommendations for the Bolting Integrity Program.

In RAI AMR-GENERIC-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, Item# 3.3.1-10 is not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated that there is no high-strength steel closure bolting exposed to air with steam or water leakage in auxiliary systems. Based on its review of the LRA, the staff confirmed that that there is no high-strength steel closure bolting exposed to air with steam or water leakage in auxiliary systems, and therefore, the staff finds the applicant’s determination acceptable.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.4 criteria. For those line items that apply to LRA Section 3.3.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.5 Hardening and Loss of Strength due to Elastomer Degradation

(1) LRA Section 3.3.2.2.5 states that TMI-1 will credit the External Surfaces Monitoring Program to manage hardening and loss of strength due to elastomer degradation of elastomer hoses exposed to indoor air, air with borated water leakage, and dry air in the auxiliary steam system, emergency diesel generators and auxiliary systems, instrument and control air system, reactor coolant system, and station blackout and UPS diesel generator systems. The applicant further stated that the External Surfaces Monitoring Program consists of system inspections and walkdowns, and includes periodic visual inspections of elastomer hoses within the scope of license renewal and subject to an AMR in order to manage aging effects. The applicant also stated that the program manages aging effects through visual inspection of elastomer surfaces for evidence of elastomer degradation.

LRA Section 3.3.2.2.5 also states that TMI-1 will implement Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage hardening and loss of strength due to elastomer degradation of elastomer expansion joints exposed to indoor air and wetted air in the auxiliary and fuel handling building ventilation systems, control building ventilation system, diesel generator building ventilation system, intake screen and pump house ventilation system, intermediate building ventilation system, and primary containment heating and ventilation system.

The applicant further stated that these internal inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection.

The staff reviewed LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5, which states that hardening and loss of strength due to elastomer degradation may occur in elastomeric seals and components associated with auxiliary heating and ventilation systems that are exposed either internally or externally to uncontrolled indoor air. The SRP-LR recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.5 invokes AMR Item 11 in Table 3 of the GALL Report, Volume 1, and AMR Items VII.F1-7, VII.F2-7, VII.F3-7 and VII.F4-6 in the GALL Report, Volume 2, as applicable to elastomeric seals and components in control room, auxiliary and radwaste, primary containment, and diesel generator building heating and ventilation systems that are exposed either internally or externally to uncontrolled indoor air.

The staff reviewed the External Surface Monitoring Program and finds that the program provides for management of aging effects through visual inspection of external surfaces for evidence hardening and loss of strength and loss of material. The applicant stated that visual inspections will be augmented by physical manipulation to detect hardening and loss of strength of elastomers. The staff determined that additional information was required in order to complete its review. In part 2 of RAI B.2.1.21-1, dated September 29, 2008, the staff requested that the applicant provide additional information to justify the basis for including elastomers in the scope of the External Surfaces Monitoring Program, to explain how the program will adequately manage the aging effects of hardening and loss of strength as it applies to the additional non-metallic components added to the scope of the program, and to describe the specific inspection techniques that will be used to detect the applicable aging effects for elastomers and clarify the acceptance criteria that will be used for these inspection techniques.

In its response to the RAI dated October 20, 2008, the applicant stated that the visual inspection will look for cracking and flaking. The applicant further stated that a resiliency test will be performed by compressing the material and observing a return to the original shape. The staff reviewed the External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff finds the External Surface Monitoring Program acceptable because visual inspections of external surfaces for cracking and flaking will be performed periodically and physical manipulation of the elastomeric components will be performed, including a resiliency test, to detect the aging effects of hardening and loss of strength.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.21-1 acceptable because a visual inspection will be conducted that will look for cracking and flaking and a resiliency test will also be conducted by compressing the material and observing a return to the original shape. The staff’s concern described in part 2 of RAI B.2.1.21-1 is resolved.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it requires periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of component intended function. The applicant stated that in addition to visual inspection, physical manipulation will be used to detect hardening and loss of strength of elastomers both internally and externally. The staff’s review of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because visual inspections of internal surfaces for cracking and flaking will be performed periodically and physical manipulation of the elastomeric components, including a resiliency test, will be performed to detect the aging effects of hardening and loss of strength.

(2) LRA Section 3.3.2.2.5 states that TMI-1 will credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage hardening and loss of strength due to elastomer degradation of elastomer hoses exposed to treated water in the auxiliary steam system. The applicant stated that these internal inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection.

The staff reviewed LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5, which states that hardening and loss of strength due to elastomer degradation may occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or to treated borated water. The GALL Report recommends that a plant-specific aging management program be evaluated to determine and assess the qualified life of the linings in the environment to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.5 invokes AMR Item 12 in Table 3 of the GALL Report, Volume 1, and AMR Item VII.A3-1 in the GALL Report, Volume 2, as applicable to elastomeric linings in PWR spent fuel pool cooling and cleanup systems that are exposed to treated borated water.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of component intended function. The applicant stated that in addition to visual inspection, physical manipulation may be used to detect hardening and loss of strength of elastomers both internally and externally. The staff determined that additional information was required in order to complete its review. In part 2 of RAI B.2.1.22-1, dated September 29, 2008, the staff requested that the applicant provide additional information to justify the basis for including neoprene and rubber in the scope of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, explain how this program will adequately manage the aging effects of hardening and loss of strength as it applies to the additional non-metallic components added to the scope of the program, describe the specific inspection techniques that will be used to detect the applicable aging effects for elastomers, and clarify the acceptance criteria that will be used for these inspection techniques.

In its response to the RAI dated October 20, 2008, the applicant stated that the visual inspection will look for cracking and flaking. The applicant further stated that a resiliency test will also be performed by compressing the material and observing a return to the original shape. The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because visual inspections of internal surfaces for cracking and flaking will be performed periodically and physical manipulation of the elastomeric components, including a resiliency test, will be performed to detect the aging effects of hardening and loss of strength.

Based on its review, the staff finds the applicant’s response to RAI B.2.1.22-1 acceptable because a visual inspection will be conducted that will look for cracking and flaking and a resiliency test will also be conducted by compressing the material and observing a return to the original shape. The staff’s concern described in part 2 of RAI B.2.1.22-1 is resolved.

Based on a review of the programs identified, the staff concludes that the applicant’s programs meet SRP-LR Section 3.3.2.2.5 criteria. For those line items that apply to LRA Section 3.3.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

LRA Section 3.3.2.2.6 describes the program to manage the loss of material and the rationale for not requiring a neutron-absorbing capacity aging management program as follows:

> Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or to treated borated water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).
>
> TMI-1 will implement a Water Chemistry program, B.2.1.2, to manage loss of material due to general corrosion of the Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water in the fuel handling and fuel storage system. The Water Chemistry Program consists of measures that are used to manage aging of piping, piping components, piping elements and heat exchangers and mitigate damage caused by corrosion and stress corrosion cracking (SCC). The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on industry guidelines for primary water and secondary water chemistry such as EPRI TR-105714, Rev. 3 and TR-102134, Rev. 3 or later revisions. The Water Chemistry Program is described in Appendix B.
>
> Reduction of neutron-absorbing capacity of the Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water is insignificant and requires no aging management. The potential for aging effects due to sustained irradiation of Boral was previously evaluated by the staff (BNL-NUREG-25582, dated January 1979; NUREG-1787, VC Summer SER, paragraph 3.5.2.4.2, page 3-406) and determined to be insignificant. Plant operating experience with Boral coupons inspected in 1995, 1997, 1999, and 2001 is consistent with the staff's conclusion and an aging management program is not required.

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section 3.3.2.2.6 on the applicant's management of the loss of material to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff also reviewed the rationale for not requiring a neutron-absorbing capacity aging management program.

The staff reviewed LRA Section 3.3.2.2.6 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.6 and in GALL AMR Item VII.A2-5 of the GALL Report, Volume 2.

The staff questioned that the rationale provided by the applicant for not requiring an aging management program for the neutron-absorbing capacity was adequate. After teleconferences with the applicant, the staff noted that TMI-1 does have a Boral Surveillance Program in place. The staff also required more information about the details of the Water Chemistry Program's management of the loss of material due to the general corrosion of Boral. In RAI 3.3.2.2.6-1, dated October 20, 2008, the staff requested that the applicant provide additional information concerning the details of the Boral Surveillance Program and the Water Chemistry Program.

In its response to the RAI dated November 12, 2008, the applicant provided information on the Boral Surveillance Program, relevant operating experience, and the Water Chemistry Program. Also, the applicant made the following commitment: “Boral test coupon surveillance will continue through the period of extended operation.”

The applicant responded with more details on the method of testing in the Boral Surveillance Program by stating:

> The TMI-1 Boral test coupon surveillance program directs coupon testing in accordance with the spent fuel rack manufacturer's recommendations. The coupon is removed from the test coupon tree located in the spent fuel pool and is shipped to a contractor measurement laboratory. The measurement laboratory characterizes the test coupon in conformance with the rack manufacturer's procedure. Inspection of the test coupon includes visual observation and photography, dimensional measurements, weight and density/specific gravity, and neutron attenuation. The coupon is visually examined to detect pitting, swelling, or other degradation. The coupon may be photographed if, in the judgment of the technician, there is any information of significance that should be photographically documented. Length and width of the coupon are measured at multiple locations (three each per coupon) for comparison to the original (pre-irradiated) dimensions. Thickness of the coupon is measured at multiple locations (five per coupon) for comparison to the original dimensions. Coupon weight and density/specific gravity are measured and calculated. Neutron attenuation is measured using a collimated thermal neutron beam. The counting intervals used are sufficient to assure the standard error due to counting statistics is essentially negligible (<0.15%) at the lowest counting rate.

The staff has reviewed the testing aspects of the program and has found them to be acceptable since there is extensive testing that would ensure that degradation of the coupons would be detected. Also, the measurements of neutron attenuation, physical distortion, and weight change would precede a loss of functionality in the Boral panels, and by performing these measurements, the program provides assurance that degradation would be detected before loss of functionality.

The applicant responded with details on the Boral coupons used by stating:

> Two coupon sample trees are located in the TMI-1 spent fuel pool. A total of fourteen sample coupons remain. At the nominal rate of one coupon sampled every five years, a more than sufficient number of coupons remains to maintain the sampling frequency through the period of extended operation.
>
> - Upon installation in 1992 of the high density fuel storage racks containing the Boral absorber material, one coupon tree, intended for long-term testing, was located in the spent fuel pool in a manner such that it was surrounded by freshly discharged spent fuel assemblies. The second coupon tree was intended for accelerated exposure. This tree was located such that it was surrounded by hot, freshly discharged fuel for each of the first five cycles following installation of the racks containing Boral. This coupon tree has remained in the last location following the fifth cycle discharge. This sample location strategy meets the recommendations from the rack manufacturer.
>
> - The Boral sample coupons are encased in stainless steel jackets of an alloy identical to that used in the storage racks, formed so as to encase the Boral and fix

it in position with tolerances similar to those for the storage racks. The Boral coupon specimens are fully exposed to the pool water, as are the Boral absorber panels in the vented storage racks.

- The coupon is visually examined to detect pitting, swelling, or other degradation such as blistering. The coupon may be photographed if, in the judgment of the technician, there is any information of significance that should be photographically documented. Areal density is determined from neutron attenuation, which is measured using a collimated thermal neutron beam. The counting intervals used are sufficient to assure the standard error due to counting statistics is essentially negligible (<0.15%) at the lowest counting rate. A collimated beam of thermalized neutrons is passed through the sample in a perpendicular direction. The number of neutrons emerging is counted with a neutron detector. By comparing the counting rate for the surveillance sample with a corresponding rate from a standard sample, the relative transmission is determined.
- To date, TMI-1 has not reinserted test coupons into the spent fuel pool following their removal and inspection.

The staff has reviewed the details on the Boral coupons and has found it to be acceptable since there are a sufficient number of coupons to ensure that testing will be able to continue through the period of extended operation, and the staff considers the program to collect data from representative coupon samples to assess for stability and integrity of Boral to be acceptable for detection of aging effects.

The applicant provided details on how the Boral would be monitored and trended by stating:

> Monitoring of the Boral neutron absorber is accomplished through periodic examination of the Boral test coupons, consisting of visual observations (which may include photography), dimensional measurements (length, width, and thickness), weight and density determinations, and neutron attenuation measurements (for B-10 areal density). Results are compared to archive values from pre-irradiated samples, and with results from previous coupon examinations, summarized in reports of the surveillance compiled by the measurement laboratory and forwarded to TMI-1 Reactor Engineering for review. The results are evaluated against acceptance criteria for determination of any follow-up activities as appropriate (e.g., removal and examination of additional coupons, wet chemical analyses, radiography, etc.). The evaluation reports of the coupon examinations are maintained to provide a continuing source of data for trend analysis.

The staff has reviewed the program details regarding the monitoring and trending of Boral and has found it to be acceptable since the applicant monitors and trends the appropriate parameters to identify appropriate follow-up activities.

The applicant provided details on the acceptance criterion and corrective actions of the Boral Surveillance Program by stating:

> Acceptance criteria of the TMI-1 Boral surveillance program are as follows:
>
> - A decrease of no more than 5% in Boron-10 content as determined by neutron attenuation measurements.

- An increase in thickness at any point should not exceed 10% of the initial thickness at that point.

The Boral test coupon surveillance program was established to monitor the integrity and performance of Boral on a continuing basis and to assure that any slowly developing or long-term effects, if any, do not become significant. The surveillance program is intended to detect the onset of any significant degradation with ample time to take corrective action as may be necessary.

Changes in excess of either of the acceptance criteria require investigation and engineering evaluation as directed by TMI-1 Reactor Engineering. Based on the results of the engineering evaluation, additional activities may be determined to be appropriate. These additional activities may include:

- Early retrieval and measurement of one or more of the remaining coupons to provide corroborative evidence that the measurements are real.
- Wet chemical analyses (destructive) and radiography (non-destructive) for confirming measurements.

If corroborated results of the test coupon surveillance program do not satisfy acceptance criteria, additional actions such as in situ radiography, or "blackness testing" of the spent fuel racks, may be employed to investigate the extent of degradation, if any, in the racks. In the event that any degradation of the Boral absorber in the spent fuel racks is detected, neutron radiographs of the suspected locations may be obtained. Positive confirmation of any defects will result in evaluations to assure that required subcriticality margin is maintained. Actions may include restrictions on rack cell use, repair of the cell to restore absorber effectiveness, or installation of new racks.

The staff has reviewed the acceptance criterion and corrective actions and has found it to be acceptable since the acceptance criterion will provide assurance that corrective actions could be taken before loss of functionality would occur.

The staff has reviewed the information provided by the applicant on the details of the Boral Surveillance Program. The staff has found the specific method of testing of the Boral coupons, monitoring and trending of the Boral condition, acceptance criteria, and corrective actions to be acceptable as stated previously.

In addition, the applicant provided information in the response to RAI 3.3.2.2.6-1 regarding relevant operating experience. The applicant stated the following:

> The Seabrook operating experience report and subsequent Part 21 notification concerning bulging and blistering of a Boral surveillance coupon has had no impact on the TMI- 1 Boral test coupon surveillance program in that the existing TMI-1 program continues as planned, with removal of test coupons for examination by the measuring laboratory continuing as per the surveillance program. An Exelon evaluation of the Seabrook operating experience determined that Exelon fleet and industry Boral surveillance

programs will continue to provide data that can be interpreted by company and support organizations to determine if further action is required.

Blisters are characterized by a local area where the Boral aluminum cladding separates from the aluminum and boron carbide core and the clad is plastically deformed outward away from the core. Water intrusion into the aluminum and boron carbide core of the Boral material may occur through small voids present in the core due to the manufacturing process, and can react with the aluminum powder to form aluminum oxide and hydrogen. The appearance of blisters suggests their mechanism of formation is related to a local pressure buildup in the core causing clad/core delamination and subsequent local plastic deformation of the aluminum cladding. Neutron attenuation tests have confirmed that blisters have not altered the neutron absorption properties of the Boral material. However, blister formation has the potential to displace water from the flux trap region of the TMI-1 Region 1 fuel racks, and blister formation occurring in the TMI-1 Region 2 fuel racks has the potential to deform the sheathing material which may cause a reduction of clearance in the fuel storage cell.

In the TMI-1 Region 1 fuel storage racks, water in the flux trap region between the fuel rack storage cells thermalizes neutrons, enhancing the neutron absorber effect. In the event that a blister does not fill with water (whose intrusion into the Boral core resulted in the hydrogen generation that formed the blister), blister formation in the Boral absorber panels in the Region 1 fuel racks can displace water in the flux trap region, and a localized increase in reactivity (at the blister location) could result.

In the TMI-1 Region 2 fuel storage racks, Boral blister formation sufficient to deform the stainless steel sheathing material could cause a reduction of clearance in the affected storage location. Should blisters occur in more than one Boral panel adjacent to a single cell, and at a coincident axial elevation, the condition could become acute enough to make fuel assembly insertion or removal in that cell difficult. The TMI-1 Region 2 fuel storage rack design, however, reduces this potential due to use of a sheathing material thickness greater than the typical sheathing thickness (and, for example, greater than the sheathing thickness in the TMI-1 Region 1 storage racks, which due to the storage rack design are not subject to cell clearance reduction due to sheathing deformation). Since resistance to sheathing displacement is increased, a subsequent decrease of clearance in the cell is less likely than in a storage rack design that uses thinner sheathing material.

These effects are not safety concerns at TMI-1 since continuation of the TMI-1 Boral test coupon surveillance program through the period of extended operation, as well as monitoring and evaluation of Exelon fleet and industry operational and testing experience, will allow the onset of any degradation in the Boral material to be detected early so that appropriate mitigation measures may be applied.

Bulging deformation of storage rack cells that had been observed in some early unvented rack designs was due to swelling of the unvented Boral storage pockets when hydrogen gas was generated during development of the protective oxide film on the aluminum surface of the Boral material when first immersed in the pool water. Subsequent rack designs, including TMI-1's storage racks, are of the vented design where any hydrogen that may be generated during the passivation process is permitted to escape the rack cell's Boral panel storage pocket.

> Swelling was observed in early foreign applications of Boral in storage racks manufactured in the 1980s. The cause of swelling in these early panels was corrected in later production by instituting appropriate controls on the boron carbide chemical composition. The Holtec procured Boral panels utilized in TMI-1's storage racks were manufactured under quality assurance/quality control programs that conform to the requirements of 10 CFR 50 Appendix B. These Boral panels have performed well in the industry in part as a result of the development of a Holtec procurement specification for Boral, which imposed stricter controls on the manufacturing process and amounts of key materials.
>
> Generalized corrosion and localized pitting corrosion of the aluminum cladding material of the Boral panels can occur in the spent fuel pool environment. However, in the boric acid solution typical of TMI-1 and other PWR spent fuel pools, generalized corrosion does not occur. The EPRI Handbook of Neutron Absorber Materials for Spent Nuclear Fuel Transportation and Storage, 2006 Edition, has reported that localized pitting has been observed in test specimens. Causes were determined to be the presence of corrosion occurring along the boundaries of long thin grains along the edge of the Boral material caused by the rolling processing, impurities in the aluminum powder and boron carbide used to manufacture the core matrix, and incomplete cleaning of metallurgical oils used in the rolling process. These corrosion degradations have not resulted in any decrease in Boron-10 areal density, and consequently have not diminished the Boral material's effectiveness in neutron absorption.
>
> These effects are, not safety concerns at TMI-1 since continuation of the TMI-1 Boral test coupon surveillance program through the period of extended operation, as well as monitoring and evaluation of Exelon fleet and industry operational and testing experience, will allow the onset of any degradation in the Boral material to be detected early so that appropriate mitigation measures may be applied.

The staff has reviewed and confirmed the operating experience and the staff finds this acceptable since the operating experience supports the conclusion that the implementation of the Boral Surveillance Program will continue to be able to manage the loss of neutron-absorbing capacity and degradation of Boral effectively.

The applicant in response to the Water Chemistry part of RAI 3.3.2.2.6-1 has stated:

> The Water Chemistry program manages loss of material due to general corrosion of the aluminum cladding of the Boral material by controlling and monitoring the spent fuel pool water chemistry. The boric acid solution concentration in the spent fuel pool water inventory is maintained at a goal level to assure that loss of material due to general corrosion of the aluminum cladding of the Boral material is adequately managed. The spent fuel pool water inventory is sampled and analyzed for Boron on a frequency of at least once per seven days. The goal concentration for Boron in the spent fuel pool water inventory is greater than or equal to 2500 ppm, and less than 5000 ppm. If the Boron concentration is found to be less than the minimum goal value, plant Operations, and Chemistry Supervision are to be immediately notified, with actions initiated to return the parameter to the specified range. Per the EPRI Handbook of Neutron Absorber Materials for Spent Nuclear Fuel Transportation and Storage, 2006 Edition, in a 2500 ppm boric aid solution, generalized corrosion of aluminum does not occur.
>
> In addition to Boron, the spent fuel pool water inventory is sampled and analyzed for parameters including pH, Chloride, Fluoride, Sulfate, Silica, Aluminum, Calcium,

Magnesium, and others. More details on the Water Chemistry program, B.2.1.2, are available in the TMI-1 LRA in Appendix B.

The staff has reviewed the Water Chemistry Program response from the applicant and finds that the response provides adequate assurance that the program will be able to adequately manage the loss of material from the general corrosion of Boral since the program has controls to ensure that the correct boron concentration is in the pool.

The staff reviewed the applicant's response and finds that it adequately explains that through the use of the Boral Surveillance Program, the reduction of neutron absorption capacity aging effect, will be adequately managed for the period of extended operation. Additionally, the staff finds that the applicant's Water Chemistry Program will adequately manage the aging effect of loss of material because the program has controls to ensure the correct boron concentration in the pool. The staff's concern described in RAI 3.3.2.2.6-1 is resolved.

In response to RAI 3.3.2.2.6-1, the applicant made an addition to the Appendix A, A.5 License Renewal Commitment List. There, the applicant makes the commitment that the "Boral test coupon surveillance will continue through the period of extended operation." This is found to be acceptable by the staff since it gives assurance that the neutron-absorbing capacity will be adequately managed in the period of extended operation.

On the basis of its technical review of the applicant's Boral Surveillance Program and Water Chemistry Program, the staff concludes that the applicant has demonstrated that effects of 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 commitment and concludes that it provides adequate assurance that the program will be maintained in the period of license extension.

3.3.2.2.7 Loss of Material due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7.

(1) LRA Section 3.3.2.2.7 refers to LRA Table 3.3.1, line items 14, 15, and 16, and addresses loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to lubricating oil; for steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil; and for steel reactor coolant pump oil collection system tank exposed to lubricating oil. The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil (as part of the fire protection system).

In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, Items 3.3.1-14, 15, and 16 are not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated the following:

Item 3.3.1-14: TMI-1 predicts the additional aging effect/mechanism of loss of material/MIC for carbon steel in lubricating oil. This component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-12.

Item 3.3.1-15: Component/material combination does not exist in Auxiliary Systems. The TMI-1 reactor coolant pump lubricating oil collection components are stainless steel. Line item 3.3.1-33 addresses the stainless steel reactor coolant pump lubricating oil collection components. See LRA Section 3.3.2.2.12.2.

Item 3.3.1-16: Component/material combination does not exist in Auxiliary Systems. The TMI-1 reactor coolant pump lubricating oil collection components are stainless steel. Line item 3.3.1-33 addresses the stainless steel reactor coolant pump lubricating oil collection components. See LRA Section 3.3.2.2.12.2.

Based on its review of the LRA, the staff confirmed the following:

That TMI-1 predicts the additional aging effect/mechanism of loss of material/MIC for carbon steel in lubricating oil and that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-12.

That the TMI-1 reactor coolant pump lubricating oil collection components are stainless steel and line item 3.3.1-33 addresses the stainless steel reactor coolant pump lubricating oil collection components.

The staff finds the applicant's determination acceptable.

(2) LRA Section 3.3.2.2.7 addresses loss of material due to general, pitting, and crevice corrosion, stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water.

TMI-1 is a PWR and does not have reactor water cleanup and shutdown cooling systems. On this basis, the staff finds that this item is not applicable to TMI-1.

(3) LRA Section 3.3.2.2.7 addresses loss of material due to general (steel only), pitting and crevice corrosion in steel and stainless steel diesel engine exhaust piping, piping components and piping elements exposed to diesel exhaust. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in steel and stainless steel internal surfaces exposed to diesel exhaust. The staff reviewed LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7, which states that loss of material due to general (steel only), pitting and crevice corrosion may occur in steel and stainless steel diesel engine exhaust piping, piping components and piping elements exposed to diesel exhaust.

The GALL Report, under Item VII.H2-2 recommends that a plant-specific program be credited to manage aging effect for steel and stainless steel piping, piping components and piping elements in the auxiliary systems.

The staff confirmed that only piping, fittings and expansion joints that align to GALL AMRs VII.H2-2 for the emergency diesel generators and auxiliary system and the station blackout and UPS diesel generator system that are fabricated from steel and stainless steel materials that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are applicable to TMI-1.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to general (steel only), pitting and crevice corrosion in steel and stainless steel diesel exhaust piping, piping components and piping elements exposed to diesel exhaust on the internal surface.

Based on a review of the program identified above, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.7 criteria. For those line items that apply to LRA Section 3.3.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Loss of Material due to General, Pitting, Crevice, and MIC

The staff reviewed LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8.

LRA Section 3.3.2.2.8 states that the Buried Piping and Tanks Inspection Program, will be implemented to manage the loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of the steel (with or without coating or wrapping) piping, piping components, piping elements, and structural members exposed to soil in the circulating water system, emergency diesel generators and auxiliaries system, fire protection system, instrument and control air system, open cycle cooling water system, primary containment heating and ventilation system, station blackout and UPS diesel generator systems, and dike/flood control system.

The staff reviewed LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8, which states that states that loss of material due to general, pitting, crevice corrosion, and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The staff reviewed the Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.2.15. The staff finds that this program provides focused and opportunistic excavations and inspections for general, pitting, crevice, and microbiologically-influenced corrosion of buried steel piping and tanks within ten years before the period of extended operation and within ten years after the initiation of the period of operation except for the buried diesel generator fuel storage 30,000 gallon tank. The walls of this tank will be subjected to ultrasonic testing from the inside of tank to verify acceptable wall thickness. The operating experience regarding buried piping and tanks at TMI-1 did not indicate adverse trends of piping degradation. The results of focused and opportunistic inspection of buried piping and tanks will be evaluated and any degradation will be evaluated through the applicant's corrective action program where repair and replacement options and inspection frequency will be addressed. Therefore, the staff finds that, based on a review of the program identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.8.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8 criteria. For those line items that apply to LRA Section 3.2.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.9 Loss of Material due to General, Pitting, Crevice, MIC and Fouling

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9.

(1) LRA Section 3.3.2.2.9 states that the One-Time Inspection Program, will be implemented to verify the effectiveness of the Fuel Oil Chemistry Program to manage the loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling of the steel piping, piping components, piping elements, and tanks exposed to fuel oil in the auxiliary steam system, emergency diesel generators and auxiliary systems, fuel oil system, and station blackout and UPS diesel systems.

    The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9 which states that loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel piping, piping components, piping elements, and tanks exposed to fuel oil. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. Corrosion or fouling may occur at locations where contaminants accumulate. The effectiveness of the fuel oil chemistry control should be verified to ensure that corrosion is not occurring.

    The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, crevice, MIC, and fouling to verify the effectiveness of the Fuel Oil Chemistry Program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

    The staff reviewed the Fuel Oil Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.2.14 respectively. The staff finds that that these programs 1) provide for periodic sampling of fuel oil and periodic, draining, cleaning and visual inspection of fuel tanks to maintain contaminants at acceptable limits to preclude loss of material due to pitting and corrosion and 2) will require one-time inspection of select susceptible steel piping, piping components, piping elements, and tanks exposed to fuel oil for loss of material due to general, pitting, crevice and microbiologically-influenced corrosion and fouling to verify the effectiveness of the Fuel Oil Chemistry Program in applicable auxiliary systems. Therefore, the staff finds that, based on a review of the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9.1.

(2) LRA Section 3.3.2.2.9 addresses loss of material due to general, pitting, crevice, microbiologically-influenced corrosion and fouling in steel piping, piping components and elements and tanks exposed to fuel oil. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in steel internal surfaces exposed to internal fuel oil environment. The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9, which states that loss of material due to general, pitting, crevice, microbiologically-influenced corrosion and fouling may occur in steel piping, piping components and elements and tanks exposed to fuel oil. The GALL Report, under Item VII.H1-10 and VII.H2-24 recommends that the Fuel Oil Chemistry Program be credited to manage this aging effect and that a plant-specific AMP be evaluated and credited to verify that the Fuel Oil Chemistry Program is effective. These GALL AMRs identify a One-Time Inspection Program is an acceptable AMP to credit for the verification of the effectiveness of the Fuel Oil Chemistry Program.

The staff confirmed that only tanks, piping and fittings that align to GALL AMRs VII.H1-1 for the Emergency Diesel Generators and Auxiliary System and the Station Blackout and UPS Diesel Generator System that are fabricated from steel materials that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, are applicable to TMI-1.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities are adequate to manage loss of material due to general, pitting, crevice, microbiologically-influenced corrosion and fouling in steel piping, piping components, piping elements and tanks exposed to fuel oil on the internal surface.

(3) LRA Section 3.3.2.2.9 states that the One-Time Inspection Program, will be implemented to verify the effectiveness of the Lubricating Oil Analysis Program, to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion of steel piping, piping components, and piping elements exposed to lubricating oil in the reactor coolant system. Fouling is not predicted for this component, material and environment combination.

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9 which states that loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The applicant stated that fouling of steel piping, piping components, and piping elements exposed to a lubricating oil environment is not predicted. In RAI 3.3.1.21-1, dated October 16, 2008, the staff requested that the applicant provide additional information that demonstrates steel piping, piping components and piping elements are not subject to fouling when exposed to lubricating oil.

In its response to the RAI dated November 12, 2008, the applicant stated that the EPRI Report 1010639, "Non-Class 1 Mechanical Tools," Revision 4, Appendix C, Table 4-1 does not predict the fouling of steel piping when exposed to lubricating oil. The staff noted that citing the EPRI Report 1010639 alone did not provide sufficient information for the staff to complete its evaluation.

In RAI AMR-GENERIC-3, dated January 05, 2009, the staff requested that the applicant provide additional information stating the reason why fouling is not predicted for steel components in lubricating oil.

In response to the RAI dated January 12, 2009, the applicant stated that fouling is not predicted because microorganisms are not expected in lubricating oil because water contamination that is necessary to support microorganisms is not present in lubricating oil. The applicant further stated even if a fouling deposit caused the aging effect of loss of material, a one-time inspection for other aging mechanisms would manage fouling as well.

Based on its review, the staff finds the applicant's response to the RAI acceptable because loss of material due to fouling of steel piping and piping is not likely to occur because the water contamination necessary for microorganisms to cause fouling is not generally found in lubricating oil and if fouling is active in lubricating oil, a one-time inspection of select components will identify it.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and documents its review in SER Sections 3.0.3.2.18 and 3.0.3.2.14 respectively and found that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, crevice and microbiologically-influenced corrosion and fouling and 2) will require one-time inspection of select susceptible steel pump and valve components for loss of material due to general, pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable auxiliary systems.

Based on a review of the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those line items that apply to LRA Section 3.3.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10.

(1) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in steel piping with elastomer lining exposed to treated borated water, stating that this aging effect is not applicable to TMI-1 which is a PWR.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded.

In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, line item 3.3.1-22 is not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated the item is not applicable because there are no steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water in auxiliary systems.

The staff confirmed that there are no elastomer-lined steel components within the scope of license renewal for auxiliary systems. Based on this, the staff finds that the item does not apply to TMI-1.

(2) LRA Section 3.3.2.2.10 addresses the applicant's aging management basis for managing loss of material due to pitting and crevice corrosion in stainless steel and steel with stainless steel cladding heat exchanger components, tanks, penetration bellows, support members, and the fuel transfer canal liner, and in aluminum support members exposed to treated water in the closed-cycle cooling water system, the component supports commodities group, the fuel handling building, the miscellaneous floor and equipment drains system, and the reactor building. The applicant stated that the aging effect of loss of material due to pitting and crevice corrosion in these components will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states that loss of material due to pitting and crevice corrosion may occur in stainless steel and aluminum piping, piping components, piping elements, and in stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The SRP-LR states that the existing AMP monitors and controls reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion, but that high concentrations of impurities in crevices and with stagnant flow conditions may cause pitting or crevice corrosion; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of water chemistry control programs. The SRP-LR states that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds the applicant's Water Chemistry

Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that that the applicant's One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material in susceptible locations due to pitting or crevice corrosion for components within the scope of the program. Based on the staff's determination that the applicant's Water Chemistry Program provides mitigation and the applicant's One-Time Inspection Program provides detection for the aging effect of loss of material due to pitting or crevice corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to pitting and crevice corrosion of the stainless steel and steel with stainless steel cladding heat exchanger components, tanks, penetration bellows, support members, fuel transfer canal liner, and aluminum support members exposed to treated water in the closed-cycle cooling water system, the component supports commodities group, the fuel handling building, the miscellaneous floor and equipment drains system, and the reactor building to be acceptable.

(3) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in copper alloy HVAC piping, piping components and piping elements exposed to condensation. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program or the External Surfaces Monitoring program will manage this aging effect in copper alloy internal surfaces or external surfaces, respectively, exposed to condensation (i.e. outdoor air, wetted air/gas and air with borated water leakage). The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states that loss of material due to pitting and crevice corrosion may occur in copper alloy HVAC piping, piping components and piping elements exposed to condensation.

The GALL Report, under Items VII.F1-16, VII.F2-14, VII.F3-16 and VII.F4-12 and SRP-LR Section 3.3.2.2.10.3 recommends that a plant-specific program be credited to manage this aging effect for copper alloy HVAC piping, piping components and piping elements in the auxiliary Systems.

The staff confirmed that only heat exchanger components, piping, fittings and valve bodies that align to GALL AMRs VII.F1-16 for the reactor building spray system, fuel oil system and the control building ventilation system that are fabricated from copper alloy materials that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program or the External Surface Monitoring Program are applicable to TMI-1. The staff noted that the reactor building spray system in which the applicant referenced Item VII.F1-16, is not an auxiliary system, but was grouped together with this GALL AMR item because the material, environment, and aging effect combination corresponded.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion in copper alloy HVAC piping, piping components and elements exposed to wetted air/gas environment on the internal surface.

The staff noted that for those AMR line items in LRA Section 3.2, in which the applicant references Item 3.3.1-25, the applicant listed the environment as air with borated water leakage, which is a more aggressive environment than a condensation environment. The staff confirmed in LRA Section 3.2, that for the same system, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program, which is consistent with the GALL Report. The staff noted that the applicant is managing aging of these components for loss of material due to pitting and crevice corrosion with the External Surfaces Monitoring Program. The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections performed during system walkdowns, is adequate to manage loss of material due to pitting and crevice corrosion for copper alloy HVAC piping, piping components, and piping elements exposed to an external condensation environment addressed by this AMR. The staff finds that the External Surfaces Monitoring Program requires periodic visual inspections of external surfaces during periodic system maintenance to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion for copper alloy HVAC piping, piping components and piping elements exposed condensation on the external surface.

(4) LRA Section 3.3.2.2.10 states that the One-Time Inspection Program will be implemented to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the loss of material due to pitting and crevice corrosion of the copper alloy heat exchanger components exposed to lubricating oil in the closed cycle cooling water system.

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10 which states that loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and documented its findings in SER Sections 3.0.3.2.18 and 3.0.3.2.14 respectively and found that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting and crevice corrosion and 2) will require one-time inspection of select susceptible copper alloy piping, piping components, and piping elements exposed to lubricating oil for loss of material due to pitting and crevice corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in the closed cycle cooling water system. Therefore, the staff finds that, based on a review of the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.

LRA Section 3.3.2.2.10 states that Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, will be implemented to manage the loss of material due to pitting and crevice corrosion of the copper alloy piping, piping components, and piping elements exposed to waste lubricating oil in the Radwaste System. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program consists of inspections of the copper alloy piping, piping components, and piping elements exposed to lubricating oil that are not covered by other aging management programs. These inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. The program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in copper alloy piping and components exposed to lubricating oil. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in copper alloy piping and components exposed to lubricating oil. The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states that loss of material due to pitting and crevice corrosion may occur in copper alloy piping and components exposed to lubricating oil.

The GALL Report, under Items VII.C1-8, VII.C2-5, VII.E1-12, VII.E4-6, VII.G-11 and VII.H2-10 and SRP-LR Section 3.3.2.2.10 recommends that Lubricating Oil Analysis Program be credited to manage this aging effect and that a plant-specific AMP be evaluated and credited to verify that the Lubricating Oil Analysis Program is achieving its mitigative function to manage this aging effect for copper alloy piping and piping components and elements. These GALL AMRs states that a one-time inspection program is an acceptable AMP to credit for the verification of the effectiveness of the Lubricating Oil Analysis Program.

The staff confirmed that only pump casings, sight glasses and valve bodies that align to GALL AMRs VII.E1-12 for the radwaste system that are fabricated from copper alloy materials that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are applicable to TMI-1.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping, piping components and elements exposed to lubricating oil.

(5) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in stainless steel internal surfaces exposed to condensation

(wetted air/gas). The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states that loss of material due to pitting and crevice corrosion may occur in HVAC aluminum piping, piping components and piping elements and stainless steel ducting components exposed to condensation. The staff noted that only stainless steel components is applicable to TMI-1 and therefore the portion relating to aluminum components will not be discussed in this section of the SER.

The GALL Report, under Item VII.F1-1, VII.F2-1, VII.F3-1, VII.F1-14, VII.F2-12, VII.F3-14 and VII.F4-10 and SRP-LR Section 3.3.2.2.10.5 recommends that a plant-specific program be credited to address this aging effect for stainless steel ducting and components and piping elements in the auxiliary systems.

The staff confirmed that only filter housing, piping, fittings, sight glasses, steam traps, tanks, thermowells and valve bodies that align to GALL AMRs VII.F1-1, VII.F2-1 and VII.F3-1 for the auxiliary and fuel handling ventilation system, extraction steam system, main steam system, primary containment heating and ventilation system and the steam turbine and auxiliary system that are fabricated from stainless steel materials are applicable to TMI-1 that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the steam turbine and auxiliary system, the extraction steam system, and the main steam system in which the applicant has referenced Item VII.F1-1, are not auxiliary systems, but were grouped together with this GALL AMR item because the material, environment, and aging effect combination corresponded.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion in stainless steel components exposed to condensation. (6) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion in copper alloy fire protection system piping, piping components and piping elements exposed to internal condensation. The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program performs visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping, piping components and piping elements exposed to internal condensation. LRA Section 3.3.2.2.10 states that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be used to manage loss of material due to pitting and crevice corrosion of the cooper alloy piping, piping components and piping elements exposed to wetted air in the emergency diesel generators and auxiliary system, radwaste system, and reactor building spray system. The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and that it is adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping, piping components and piping elements exposed to internal condensation.

LRA Section 3.3.2.2.10 states that the Compressed Air Monitoring Program will be used to manage loss of material due to pitting and crevice corrosion of the copper alloy piping, piping components, piping elements, and heat exchanger components exposed to wetted air in the control building ventilation system, and instrument and control air system. The applicant stated that the Compressed Air Monitoring Program consists of inspections of the internal surfaces of copper alloy components.

SRP-LR Section 3.3.2.2.10 invokes AMR Item 28 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.G-9, applicable to copper alloy piping components exposed to condensation in the fire protection system, and recommends a plant-specific aging management program.

The staff reviewed the Compressed Air Monitoring Program, which includes periodic visual inspection of internal surfaces of piping and heat exchanger components for loss of material and fouling, monitoring of system air quality in accordance with industry standards and guidelines, and is consistent with the GALL AMP XI.M24, “Compressed Air Monitoring.” The staff reviewed the Compressed Air Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.8. On the basis that periodic visual inspection will be performed, the staff finds that the Compressed Air Monitoring program will adequately manage loss of material due to pitting and crevice corrosion of copper alloy piping, piping components, piping elements, and heat exchanger components exposed to wetted air in the control building ventilation system, and instrument and control air system through the period of extended operation.

Based on a review of the programs identified, the staff concludes that the applicant’s programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.10 states that the Fire Protection Program will be used to manage loss of material due to pitting and crevice corrosion of the copper alloy spray nozzles exposed to wetted air in the fire protection System. The applicant further stated that the Fire Protection Program includes monitoring, testing, and inspection activities including low-pressure carbon dioxide fire suppression system flow testing to verify flow from each nozzle. The applicant also stated that any adverse conditions such as broken or missing parts, loose fasteners, excessive dirt or debris, or other degrading condition are required to be reported for corrective action evaluation.

SRP-LR Section 3.3.2.2.10 invokes AMR Item 28 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.G-9, applicable to copper alloy piping components exposed to condensation in the fire protection system, and recommends a plant-specific aging management program.

The staff reviewed the Fire Protection Program, which includes inspection and performance testing of low-pressure carbon dioxide system components at periodic intervals, and is consistent with GALL AMP XI.M26, “Fire Protection.” The staff reviewed the Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.9. On the basis that inspection and testing will be performed, the staff finds that the Fire Protection Program will adequately manage loss of material due to pitting and crevice corrosion of copper alloy spray nozzles exposed to wetted air in the fire protection system through the period of extended operation.

LRA Section 3.3.2.2.10 states that the Fire Water System Program will be used to manage loss of material due to pitting and crevice corrosion of the copper alloy sprinkler heads exposed to wetted air in the fire protection system. The Fire Water System Program manages the aging effects of fire water system sprinkler heads through system monitoring, periodic tests and inspection activities.

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system components exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.10 invokes AMR Item 28 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.G-9, applicable to copper alloy piping components exposed to condensation in the fire protection system, and recommends a plant-specific aging management program.

The staff reviewed the Fire Water System Program, which manages identified aging effects for the water-based fire protection system and associated components, through the use of periodic inspections, monitoring, and performance testing, and finds that it is consistent with the GALL AMP XI.M27, “Fire Water System.” As recommended by the GALL AMP XI.M27, the applicant has committed to testing or replacement of sprinkler heads that have been in service for 50 years. The staff’s review of the Fire Water System Program and its evaluation is documented in SER Section 3.0.3.2.10. On the basis that the sprinkler heads will be tested or replaced, the staff finds that the Fire Water System Program will adequately manage loss of material due to pitting and crevice corrosion of copper alloy sprinkler heads exposed to wetted air in the fire protection system through the period of extended operation.

(7) LRA Section 3.3.2.2.10 states that the Buried Piping and Tanks Inspection Program, will be implemented to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components, and piping elements exposed to soil in the fire protection system. The Buried Piping and Tanks Inspection Program consists of preventive measures to mitigate corrosion and periodic inspection to manage the effects of corrosion on the pressure-retaining capacity of buried stainless steel piping, piping components, and piping elements.

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10 which states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

In LRA Table 3.3.2-10, the applicant stated that loss of material of stainless steel piping exposed to the buried (ext) environment is managed with the Buried Piping and Tank Inspection Program. During the audit, the staff noted that for the AMR results line that references LRA Table 3.3.2, the applicant included a reference to Generic Note E. The staff reviewed the AMR results line referenced to Generic Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends a plant specific program, the applicant has proposed using the Buried Piping and Tank Inspection Program.

The staff reviewed the Buried Piping and Tanks Inspection Program, and its evaluation is documented in SER Section 3.0.3.2.15. The staff finds that this program will provide planned inspections within ten years from entering the period of extended operation unless an opportunistic inspection has occurred within this ten-year period for stainless steel components exposed to soil for loss of material due to pitting and crevice corrosion in Fire Protection System. The LRA Appendix B, Buried Piping and Tanks Inspection Program is in accordance with the recommendations of GALL AMP XI.M34 "Buried Piping and Tanks Inspection." The staff noted that although GALL AMP XI.M34 cites applicability to only steel and gray cast iron components, stainless steel components that are subject to the provisions of GALL AMP XI.M34 will also be adequately managed for loss of material. The staff noted that the inspection methods used for buried cast iron, carbon steel and concrete-coated steel are applicable to buried stainless steel as well. The staff noted that buried stainless steel piping is more resistant to pitting and crevice corrosion than carbon steels and other materials addressed in GALL AMP XI.M34, "Buried Piping and Tanks Inspection," when exposed to soil and that visual inspection of stainless steel will detect unacceptable loss of material.

(8) LRA Section 3.3.2.2.10 addresses loss of material due to pitting and crevice corrosion, stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements of the BWR standby liquid control system exposed to sodium pentaborate solution.

TMI-1 is a PWR and does not have a standby liquid control system. The staff agrees that this item is not applicable to TMI-1.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material due to Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11. LRA Section 3.3.2.2.11 addresses loss of material due to pitting ,crevice, and galvanic corrosion, stating that this aging effect is not applicable to TMI-1, which is a PWR.

SRP-LR Section 3.3.2.2.11 states that loss of material due to pitting, crevice, and galvanic corrosion may occur in copper alloy piping, piping components, and piping elements exposed to treated water.

This item pertains to loss of material in copper alloy auxiliary system components exposed to a BWR treated water environment. TMI-1 is a PWR. The staff agrees that this item is not applicable to TMI-1.

Based on the above, the staff concludes that SRP-LR Section 3.3.2.2.11 criteria do not apply.

3.3.2.2.12 Loss of Material due to Pitting, Crevice, and MIC

The staff reviewed LRA Section 3.3.2.2.12 against the criteria in SRP-LR Section 3.3.2.2.12.

(1) LRA Section 3.3.2.2.12 states that the One-Time Inspection Program, will be implemented to verify the effectiveness of the Fuel Oil Chemistry Program, to manage the loss of material due to pitting, crevice, and microbiologically-influenced corrosion of the stainless steel and copper alloy (Zn greater than 15%), piping components, and piping elements exposed to fuel oil in the auxiliary steam system, emergency diesel generators and auxiliary systems, fuel oil system, and station blackout and ups, diesels and auxiliary systems.

    The staff reviewed LRA Section 3.3.2.2.12 against the criteria in SRP-LR Section 3.3.2.2.12 which states that loss of material due to pitting, crevice, and MIC could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. Corrosion may occur at locations where contaminants accumulate and the effectiveness of fuel oil chemistry control should be verified to ensure that corrosion is not occurring. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

    The staff reviewed the Fuel Oil Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.2.14 respectively. The staff finds that that these programs 1) provide for periodic sampling of fuel oil and periodic, draining, cleaning and visual inspection of fuel tanks to maintain contaminants at acceptable limits to preclude loss of material due to pitting and corrosion and 2) will require one-time inspection of select susceptible stainless steel and copper alloy piping, piping components, piping elements to fuel oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Fuel Oil Chemistry Program in applicable auxiliary systems.

    The applicant stated that pitting and crevice corrosion is not predicted for copper alloys with zinc content less than 15% in a fuel oil environment. The staff determined that additional information was required to complete its review. In RAI 3.3.2.2-1, dated October 16, 2008, the staff requested that the applicant provide additional information that demonstrates copper alloys with zinc content less than 15% are not subject to pitting and crevice corrosion when exposed to fuel oil.

In its response to the RAI dated November 12, 2008, the applicant stated that the EPRI Report 1010639, “Non-Class 1 Mechanical Tools,” Revision 4, Appendix C, does not predict pitting and crevice corrosion of copper alloys with zinc content less than 15% when exposed to fuel oil. The staff noted that just citing EPRI Report 1010639 alone does not provide the staff with sufficient information to complete its evaluation.

In RAI AMR-Generic-3, dated January 05, 2009, the staff requested that the applicant provide additional information stating the reason why pitting and crevice corrosion are not active in copper alloys with zinc content less than 15% when exposed to fuel oil.

In its response to the RAI dated January 12, 2009, the applicant stated that in order to be consistent with corrosion of copper alloys with zinc content less than 15% exposed to lubricating oil, where pitting and crevice corrosion is predicted, pitting and crevice corrosion will be included as aging mechanisms for copper alloy with zinc content less than 15% in a fuel oil environment.

Based on its review, the staff finds that applicant’s response to RAI 3.3.2.2-1 acceptable because the changes made by the applicant to manage pitting and crevice corrosion of copper alloy with zinc content less than 15% in a fuel oil environment, result in no exception to the SRP-LR. The staff’s concern described in RAI 3.3.2.2-1 is resolved.

(2) LRA Section 3.3.2.2.12 states that the One-Time Inspection Program, will be implemented to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the loss of material due to pitting, crevice, and microbiologically-influenced corrosion of the stainless steel piping, piping components, piping elements, heat exchanger components, and tanks exposed to lubricating oil in the decay heat removal system, emergency diesel generators and auxiliaries system, makeup and purification system, reactor coolant system, and station blackout and UPS diesel generator system.

The staff reviewed LRA Section 3.3.2.2.12 against the criteria in SRP-LR Section 3.3.2.2.12 which states that loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the lubricating oil program is verified through one-time inspection of selected components at susceptible locations to ensure that corrosion is not occurring and that the component’s intended function will be maintained during the period of extended operation.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14 respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice, and microbiologically-influenced corrosion and 2) will require one-time inspection of select susceptible stainless steel piping, piping components, and piping elements exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable auxiliary systems. Therefore, the staff finds that, based on a review of the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.

(3) LRA Section 3.3.2.2.12 states that the External Surfaces Monitoring Program will be implemented to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion of the stainless steel drip pans exposed to waste lubricating oil in the fire protection system. The External Surfaces Monitoring Program consists of system inspections and walkdowns. This program includes periodic visual inspections of components within the scope of license renewal and subject to AMR in order to manage aging effects. The program manages aging effects through visual inspection of external surfaces for evidence of aging effects. The External Surfaces Monitoring program is described in Appendix B.

The staff noted that in Auxiliary System Tables 3.3.2.-2, 3.3.2-9, 3.3.2-12, and 3.3.2-24 that for copper alloy (Zn content less 15%) piping, fittings, and valves exposed to a fuel oil environment, loss of material due to microbiologically influence corrosion is managed with the Fuel Oil Chemistry Program and the One-Time Inspection Program. The applicant assigned a note "I" for these cases although the assignment of the Fuel Oil Chemistry Program and the One-Time Inspection Program to manage loss of material due to MIC is in accordance with GALL Report. In addition, the staff noted that loss of material due to MIC for copper alloys with zinc content less than 15% is addressed in Section 3.3.2.2.12 of the LRA. The staff determined that additional information was needed to complete its review. In RAI 3.3.2.2-1, dated October 16, 2008, the staff requested that the applicant provide additional information justifying the use of Note "I" (Aging effect in NUREG-1801 for this component, material and environment combination is not applicable) for copper alloy (Zn content less 15%) piping, fittings, and valves exposed to a fuel oil environment, when loss of material due to MIC is managed with the Fuel Oil Chemistry Program and the One-Time Inspection Program as addressed in the GALL Report.

In its response to the RAI dated November 12, 2008, the applicant stated that Generic Note "I" is used for this material, component, and environment because pitting and crevice corrosion does not apply for this material, component, and environment combination.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.2-1 unacceptable because the applicant did not provide the reason why Generic Note "I" was used for this material, component, and environment. The applicant also did not explain why pitting and crevice corrosion does not apply for this material, component, and environment combination.

In RAI ARM-Generic-3, dated January 5, 2009, the staff requested in part, that the applicant state the reasons why pitting and crevice corrosion is not predicted for copper alloys with less than 15% zinc in a fuel oil environment.

In its response to the RAI dated January 12, 2009, the applicant committed to manage pitting and crevice corrosion of copper alloy (Zn content less 15%) components exposed to fuel oil using the Fuel Oil Chemistry Program and the One-Time Inspection Program.

Based in its review, the staff finds the applicant's response to the applicable part of RAI-AMR-Generic-3 acceptable because the changes made by the applicant to manage pitting and crevice corrosion of copper alloy with zinc content less than 15% in a fuel oil environment, result in no exception to the GALL report. The staff concern in RAI 3.3.2.2-1 and the applicable part of RAI-AMR-Generic-3 is resolved.

LRA Section 3.3.2.2.12 addresses the loss of material due to pitting, crevice and microbiologically-influenced corrosion for stainless steel piping, piping components and piping elements exposed to lubricating oil internally or externally. The staff reviewed LRA Section 3.3.2.2.12 against the criteria in SRP-LR Section 3.3.2.2.12, which states that loss of material due to pitting, crevice and microbiologically-influenced corrosion may occur in stainless steel piping, piping components and piping elements exposed to lubricating oil internally or externally.

The GALL Report, under Items VII.C1-14, VII.C2-12, VII.E1-15, VII.E4-12, VII.G-18 and VII.H2-17 and SRP-LR Section 3.3.2.2.12 recommends that Lubricating Oil Analysis Program be credited to manage this aging effect and that a plant-specific AMP be evaluated and credited to verify that the Lubricating Oil Analysis Program is achieving its mitigative function to manage loss of material due to pitting, crevice and microbiologically-influenced corrosion for stainless steel piping, piping components. These GALL AMRs state that a one-time inspection program is an acceptable AMP to credit for the verification of the effectiveness of the Lubricating Oil Analysis Program. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program or the External Surfaces Monitoring Program will manage this aging effect in stainless steel internal surfaces or external surfaces, respectively, exposed to lubricating oil.

The staff confirmed that only piping, fittings, drip pan, tanks and valve bodies that align to GALL AMR VII.G-18 for the fire protection system that are fabricated from stainless steel materials that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program or the External Surfaces Monitoring Program are applicable to TMI-1.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are adequate to manage loss of material due to pitting, crevice and microbiologically-influenced corrosion stainless steel piping, piping components and piping elements exposed to lubricating oil on the internal surface.

The staff reviewed the applicant’s External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff finds that the External Surfaces Monitoring Program which includes periodic visual inspections performed during system walkdowns, is adequate to manage loss of material due to pitting, crevice and microbiologically-influenced corrosion and detect aging effects that could result in a loss of the component's intended function for stainless steel components exposed to external lubricating oil environment addressed by this AMR. The staff finds that this program includes activities that are adequate to manage loss of material due to pitting, crevice and MIC in stainless steel piping, piping components and piping elements exposed to lubricating oil on the external surface.

Based on a review of the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12 criteria. For those line items that apply to LRA Section 3.3.2.2.12, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.13 Loss of Material due to Wear

The staff reviewed LRA Section 3.3.2.2.13 against the criteria in SRP-LR Section 3.3.2.2.13. LRA Section 3.3.2.2.13 refers to LRA Table 3.3.1, line item 34, and addresses loss of material due to wear for elastomer seals and components exposed to air – indoor uncontrolled (internal or external). The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

SRP-LR Section 3.3.2.2.13 states that loss of material due to wear may occur in the elastomer seals and components exposed to air - indoor uncontrolled (internal or external). The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, Item 3.3.1-34 is not applicable. In its response to the RAI dated January 12, 2009, the applicant stated the item is not applicable because this component, material, environment, and aging effect/mechanism combination does not exist in auxiliary systems. The applicant also stated that the ventilation system elastomer components are not subject to relative motion between surfaces and therefore do not include the loss of material due to wear.

Based on its review of the LRA, the staff confirmed that this component, material, environment, and aging effect/mechanism combination does not exist in auxiliary systems and that the ventilation system elastomer components are not subject to relative motion between surfaces, and, therefore, the staff finds the applicant's determination acceptable.

Based on the above, the staff concludes that SRP-LR Section 3.3.2.2.13 criteria do not apply.

3.3.2.2.14 Loss of Material due to Cladding Breach

The staff reviewed LRA Section 3.3.2.2.14 against the criteria in SRP-LR Section 3.3.2.2.14.

LRA Section 3.3.2.2.14 refers to LRA Table 3.3.1, line item 35, and addresses loss of material due to cladding breach for steel with stainless steel cladding pump casing exposed to treated borated water. The applicant stated that the component, material, environment, and aging effect/mechanism does not apply to auxiliary systems.

SRP-LR Section 3.3.2.2.14 states that loss of material due to cladding breach (also referred to as underclad cracking may occur in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references IN 94-63, "Boric Acid Corrosion Of Charging Pump Casing Caused By Cladding Cracks," and recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

In RAI AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant provide additional information to justify why LRA Table 3.3.1, Item 3.3.1-35 is not applicable.

In its response to the RAI dated January 12, 2009, the applicant stated the item is not applicable because there are no steel with stainless steel cladding pump casings exposed to treated borated water in auxiliary systems.

Based on its review of the LRA, the staff confirmed that there are no steel with stainless steel cladding pump casings exposed to treated borated water in auxiliary systems and, therefore, the staff finds the applicant's determination acceptable.

Based on the above, the staff concludes that SRP-LR Section 3.3.2.2.14 criteria do not apply.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's QA program.

3.3.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.3.2-1 through 3.3.2-25, the staff reviewed additional details of 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 3.3.2-25, the applicant indicated, via 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 concerning how the aging effects will be managed. 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 had demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.3.2.3.1 Auxiliary Systems – Auxiliary and Fuel Handling Building Ventilations Systems – 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 auxiliary and fuel handling building ventilations systems component groups.

In LRA Table 3.3.2-1, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel mechanical closure bolting in an outdoor air (external) environment using the Bolting Integrity Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, microbiologically-influenced corrosion (MIC) and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures which follow NRC approved guidance. Additionally, the LRA line item is similar to GALL item VII.I-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air-outdoor (external) environment. This environment consists of moist air, exposure to weather, precipitation, and wind. TMI-1 inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. Therefore, the staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel mechanical closure bolting in an outdoor air (external) environment is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.2 Auxiliary Systems – Auxiliary Steam System – Summary of Aging Management Evaluation – LRA Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the auxiliary steam system component groups.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material due to pitting and crevice corrosion for steel material for valve bodies exposed to an air/gas wetted internal environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities, or during maintenance activities when the internal surface is accessible for visual inspections, to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.3 Auxiliary Systems – Circulating Water System – 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 circulating water system component groups.

In LRA Table 3.3.2-3, the applicant designated Note H for copper alloy heat exchanger components exposed to a lubricating oil environment in the circulating water system (Table 3.3.2-3) because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for heat exchanger components and the staff reviewed the GALL Report and concluded that the AMR line item, copper alloy heat exchanger components is not evaluated for a lubricating oil for loss of material due to pitting, crevice, microbiologically influence corrosion. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, microbiologically influence corrosion. The staff evaluated the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively.

The staff noted that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will perform one-time inspection of select susceptible components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that the one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis and the One-Time Inspection programs are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these copper alloy components through the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.4 Auxiliary Systems – Closed Cycle Cooling Water System – Summary of Aging Management Evaluation – LRA Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the closed cycle cooling water system component groups.

In LRA Table 3.3.2-4, the applicant proposed to manage reduction of heat transfer due to fouling for copper alloy with 15% zinc or more material for heat exchanger components exposed to an external air environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination. The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff further noted that these periodic visual inspections are adequate to manage reduction of heat transfer due to fouling for these components, because a visual inspection will be capable of detecting any fouling (build up from whatever source) on the internal surface of these components. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections when exposed to an internal environment of external indoor air they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-4, the applicant proposed to manage reduction of heat transfer due to fouling for copper alloy with 15% zinc or more material for heat exchanger components exposed to an external air with borated water leakage environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination. The staff confirmed in LRA Section 3.3, that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the AMP B.2.1.4, "Boric Acid Corrosion Program," as recommend by GALL.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff further noted that these periodic visual inspections are adequate to manage reduction of heat transfer due to fouling for these components exposed to external air with borated water leakage addressed by this AMR because a visual inspection will be capable of detecting any fouling (build up from whatever source) on the surface of these components. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.5 Auxiliary Systems – Containment Isolation System – Summary of Aging Management Evaluation – LRA Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the containment isolation system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.6 Auxiliary Systems – Control Building Ventilation System – Summary of Aging Management Evaluation – LRA Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the control building ventilation system component groups.

In LRA Table 3.3.2-6, the applicant stated that for glass sight glasses in closed cycle cooling water environment there are no aging effects requiring management. The applicant referenced Generic Note G for this line item, indicating that environment is not listed in the GALL Report for this component and environment combination.

As indicated in the "Corrosion Handbook" by H.H.Uhlig, the staff noted that glass, as a material, is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since the closed-cycle cooling water environment does not contain hydroflouric acid or caustics. The staff reviewed the GALL Report and noted that item VII.J-13 indicates that glass in a treated water environment has no aging effects that require aging management. On the basis that the closed cycle cooling water environment is similar to a treated water environment, the staff finds that glass in a closed cycle cooling water environment will not have any aging effects requiring aging management.

In LRA Table 3.3.2-6, the applicant proposed to manage reduction of heat transfer due to fouling for copper alloy with less than 15% zinc material for heat exchanger components exposed to an external indoor air environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff further noted that these periodic visual inspections are adequate to manage reduction of heat transfer due to fouling for these components exposed to indoor air environment addressed by this AMR because a visual inspection will be capable of detecting any fouling (build up from whatever source) on the surface of these components. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.7 Auxiliary Systems – Cranes and Hoists – Summary of Aging Management Evaluation – LRA Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the cranes and hoists component groups.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material/wear for carbon steel crane/hoist (rail system) externally exposed to outdoor air using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line item cites Generic Note E, which indicates that the material, aging effect, and environment are consistent with the NUREG-1801 however a different aging management program is credited.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is document in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every 2 years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Therefore, the staff concludes that the management of loss of material/wear for carbon steel crane/hoist (rail system) externally exposed to outdoor air is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material/general, pitting and crevice corrosion for carbon steel crane/hoist (bridge/trolley/girders), crane/hoist (jib crane columns/beams/plates/anchorage), crane/hoist (monorail beams/lifting devices/plates), and crane/hoist (rail system) externally exposed to an outdoor air environment using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program for 4 AMR line items. The AMR line items cite Generic Note E, which indicates that the material, aging effect, and environment are consistent with the NUREG-1801 however a different aging management program is credited.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every 2 years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Additionally, these particular line items reference GALL item VII.H1-8, which accounts for the same material, environment, and aging effect. The aging management program identified to manage this line item is not the "External Surfaces Monitoring Program" as specified by GALL. However, the applicant has identified this discrepancy with a plant specific note, and the staff has evaluated the proposed Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program for aging management adequacy as stated above. Therefore, the staff concludes that the management of loss of material/wear for carbon steel crane/hoist (rail system) externally exposed to outdoor air is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material/general, pitting and crevice corrosion for carbon and low alloy steel bolting externally exposed to an outdoor air environment using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line item cites Generic Note E, which indicates that the material, aging effect, and environment are consistent with the GALL Report, however a different aging management program is credited.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every 2 years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Therefore, the staff concludes that the management of loss of material/general, pitting and crevice corrosion for carbon and low alloy steel bolting externally exposed to an outdoor air environment is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material/general, pitting and crevice corrosion for carbon and low alloy steel bolting externally exposed to indoor air and air with borated water leakage environments using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program for 2 AMR line items. The AMR line items cite Generic Note E, which indicates that the material, aging effect, and environment are consistent with the GALL Report, however, a different aging management program is credited.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is document in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every 2 years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Therefore, the staff concludes that the management of loss of material/general, pitting and crevice corrosion for carbon and low alloy steel bolting externally exposed to indoor air and air with borated water leakage environments is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material/general, pitting and crevice corrosion for carbon steel crane/hoist (bridge/trolley/girders), crane/hoist (jib crane columns/beams/plates/anchorage), crane/hoist (monorail beams/lifting devices/plates), and crane/hoist (rail system) externally exposed to an air with borated water leakage environment using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program for 4 AMR line items. The AMR line items cite Generic Note E, which indicates that the material, aging effect, and environment are consistent with the GALL Report, however, a different aging management program is credited.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The LRA states that that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every 2 years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Additionally, these particular line items reference GALL item VII.I-4, which accounts for the same material, environment, and aging effect. The aging management program identified to manage this line item is not the External Surfaces Monitoring Program as specified by GALL. However, the applicant has identified this discrepancy with a plant specific note, and the staff has evaluated the proposed Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program for aging management adequacy as stated above. Therefore, the staff concludes that the management of loss of material/wear for carbon steel crane/hoist (rail system) externally exposed to outdoor air is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material/pitting, crevice and microbiologically-influenced corrosion on stainless steel crane and hoist bolting externally exposed to lubricating oil using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every 2 years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures which follow NRC approved guidance, and inspected using visual techniques. Therefore, the staff concludes that the management of loss of material/pitting, crevice and microbiologically-influenced corrosion on stainless steel crane and hoist bolting externally exposed to lubricating oil is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self-loosening of stainless steel crane and hoist bolting externally exposed to lubricating oil using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The staff verified that the Inspection of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems Program states the following: Structural bolting is monitored for loss of preload by inspecting for loose or missing bolts, or nuts. The staff determined that the method for inspecting for loss of preload specified by the Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems Program is not affected by a lubricating oil environment. Therefore, the staff concludes that the management of loss of preload/thermal effects, gasket creep, and self-loosening of stainless steel crane and hoist bolting externally exposed to lubricating oil is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of preload/self-loosening for carbon and low alloy steel crane and hoist bolting externally exposed to outdoor air using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The

AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program as documented in SER Section 3.0.3.2.7. The staff verified that AMP B.2.1.11 specifically states that: "Structural bolting is monitored for loss of preload by inspecting for loose or missing bolts, or nuts." The staff determined that the method for inspecting for loss of preload specified by AMP B.2.1.11 is adequate for this component, material and environment combination. Therefore, the staff concludes that the management of loss of preload/self-loosening for carbon and low alloy steel crane and hoist bolting externally exposed to outdoor air is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of preload/self loosening for carbon and low alloy steel crane and hoist bolting externally exposed to indoor air using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line items cite Generic Note I, which indicates that the aging effect identified in the GALL Report for this component, material and environment combination is not applicable.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The staff verified that the Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems Program states the following: Structural bolting is monitored for loss of preload by inspecting for loose or missing bolts, or nuts. The staff determined that the method for inspecting for loss of preload specified by the Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems Program is adequate for this component, material and environment combination. Therefore, the staff concludes that the management of loss of preload/self loosening for carbon and low alloy steel crane and hoist bolting externally exposed to indoor air is acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of preload/self loosening for carbon and low alloy steel crane and hoist bolting externally exposed to air with borated water leakage using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line items cite Generic Note I, which indicates that the aging effect identified in the GALL Report for this component, material and environment combination is not applicable.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The staff verified that the Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems Program specifically states the following: Structural bolting is monitored for loss of preload by inspecting for loose or missing bolts, or nuts. The staff determined that the method for inspecting for loss of preload specified by the Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems Program is adequate for this component, material and environment combination. Therefore, the staff concludes that the management of loss of preload/self loosening for carbon and low alloy steel crane and hoist bolting externally exposed to air with borated water leakage is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.8 Auxiliary Systems – Diesel Generator Building Ventilation System – Summary of Aging Management Evaluation – LRA Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the diesel generator building ventilation system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.9 Auxiliary Systems – Emergency Diesel Generators and Auxiliary Systems – 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 emergency diesel generators and auxiliary systems component groups.

In LRA Table 3.3.2-9, the applicant proposed to manage reduction of heat transfer due to fouling for copper alloy with 15% zinc or more material for heat exchanger components exposed to an external indoor air environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff further noted that these periodic visual inspections are adequate to manage reduction of heat transfer due to fouling for these components exposed to external indoor air environment addressed by this AMR because a visual inspection will be capable of detecting any fouling (build up from whatever source) on the surface of these components. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMRs for the emergency diesel generator and auxiliary system component groups. In LRA Table 3.3.2-9, the applicant stated that for glass sight glasses in a closed cycle cooling water environment there are no aging effects requiring management. The applicant referenced footnote "G" for this line item indicating that environment is not listed in the GALL Report for this component and environment combination.

As indicated in “Corrosion Handbook” by H.H.Uhlig, the staff noted that glass as a material is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since closed-cycle cooling water environment does not contain hydroflouric acid or caustics. The staff reviewed the GALL Report and noted that item VII.J-13 indicates that glass in a treated water environment has no aging effects that requires aging management. On the basis that a closed cycle cooling water environment is similar to a treated water environment, the staff finds that glass in closed cycle cooling water environment will not have any aging effects requiring aging management.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel mechanical closure bolting in an outdoor air (external) environment using the Bolting Integrity Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the applicant’s Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance. Additionally, the LRA line item is similar to GALL item VII.I-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air- outdoor (external) environment. This environment consists of moist air, exposure to weather, precipitation, and wind. TMI-1 inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. The staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel mechanical closure bolting in an outdoor air (external) environment is acceptable.

In LRA Table 3.3.2-9 the applicant designated Generic Note H for copper alloy heat exchanger components exposed to a lubricating oil environment in the emergency diesel generators and auxiliary systems because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for heat exchanger components. The staff reviewed the GALL Report and finds that the AMR line item for copper alloy heat exchanger components that are exposed to a lubricating oil environment are not evaluated for loss of material due to pitting, crevice, microbiologically influence corrosion and that Generic Note H is appropriate. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, and MIC.

The staff reviewed the Lubricating Oil Analysis Program and the One-time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff noted that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will require one-time inspection of select susceptible components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that the one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis and the One-Time Inspection programs are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these copper alloy components through the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.10 Auxiliary Systems – Fire Protection System – Summary of Aging Management Evaluation – LRA Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMRs for the fire protection system component groups.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material due to microbiologically-influenced corrosion and fouling of aluminum alloy water motor alarm in an environment of raw water by using the Fire Water System Program. The applicant referenced footnote "H" for this line item indicating that aging effect is not in the GALL Report for this component, material and environment combination.

The staff reviewed the Fire Water System Program, which manages identified aging effects for the water-based fire protection system and associated components, through the use of periodic inspections, monitoring, and performance testing, and finds that it is consistent with the GALL AMP XI.M27, "Fire Water System." The staff reviewed the Fire Water System Program and its evaluation is documented in SER Section 3.0.3.2.10. On the basis that periodic inspection and monitoring and testing will be performed, the staff finds that the Fire Water System program will adequately manage loss of material due to microbiologically-influenced corrosion and fouling of aluminum piping components exposed to raw water in the fire protection system through the period of extended operation.

In LRA Table 3.3.2-10, the applicant proposed to manage change in material properties, loss of material and cracking of mecatiss and thermo-lag material fire barriers in air-indoor and air with borated water leakage external environments by using the Fire Protection program. The applicant referenced footnote "F" indicating the material is not in the GALL Report.

The staff reviewed the Fire Protection Program, which provides for periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings and floors, and manages the aging effects of change in material properties, cracking, hardening and loss of material. The staff noted that the Fire Protection Program is consistent with the GALL AMP XI.M26, "Fire Protection," which recommends visual inspection of fire barriers at least once every refueling outage by qualified inspectors. The staff reviewed the Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.9. Based on this review, the staff finds that the Fire Protection program will adequately manage change in material properties, loss of material and cracking in fire barriers in the fire protection system through the period of extended operation because periodic inspection is performed to detect any signs of degradation before loss of intended function.

In LRA Table 3.3.2-10, the applicant proposed to manage concrete cracking and spalling and loss of material of concrete fire walls and slabs in an air with borated water leakage environment by using the Fire Protection Program. The applicant referenced footnote “G” and plant-specific footnote 18, indicating that this environment is not listed in the GALL Report for this material and component. The applicant also stated that concrete fire barriers (walls and slabs) with environment of air with borated water leakage have the same aging effects and mechanisms, and are managed with the same programs as air-indoor.

The staff reviewed the Fire Protection Program, which provides for periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings and floors. The staff noted that the Fire Protection Program is consistent with the GALL AMP XI.M26, “Fire Protection,” which recommends visual inspection of fire barriers at least once every refueling outage by qualified inspectors for any sign of degradation such as concrete cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. The staff reviewed the Fire Protection program and its evaluation is documented in SER Section 3.0.3.2.9. Based on this review, the staff finds that the Fire Protection program will adequately manage change in material properties, loss of material and cracking in fire barriers in the fire protection system through the period of extended operation because periodic inspection is performed to detect any signs of degradation before loss of intended function.

In LRA Table 3.3.2-10, the applicant stated that for polymer piping and fittings in air-indoor external and air/gas – wetted internal environments, there are no aging effects requiring management. The applicant referenced footnote “F” stating that this material is not listed in the GALL Report.

In RAI 3.3.2.3-1, dated October 16, 2008, the staff requested that the applicant provide additional information identifying what polymer material is used and to justify why there are no aging effects requiring management for this material.

In its response to the RAI dated November 12, 2008, the applicant stated the following:

> The polymer piping and fitting component used in the fire protection system is Nylon 11 tubing and it is located inside the Control Building. Nylon 11 is a polyamide material with excellent resistance to acids, including boric acid. It is heat and light stabilized with a maximum operating temperature of 70 °C (158 °F). Nylon 11 is resistant to moisture, corrosion and stress cracking, and has good flexibility. The design temperature in the Control Building is 80 °F and the radiation level is negligible. Therefore, there are no aging effects that would result from the Nylon 11 tubing contacting the air-indoor and air/gas environments inside the Control Building.

The staff reviewed the applicant’s response and noted that Nylon 11 material is highly resistant to corrosion and can withstand temperatures from -40 °F to 200 °F. The staff acknowledges that the use of Nylon 11 material for flexible tubing in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation. On the basis that the Nylon 11 tubing is located in the Control Building in an environment that does not exceed 80 °F and a non-radioactive atmosphere, the staff finds that Nylon 11 tubing will not have any aging effects requiring management in air-indoor and air/gas environments in the fire protection system.

Based on its review, the staff finds the applicant’s response to RAI 3.3.2.3-1 acceptable because the use of Nylon 11 material for flexible tubing in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation and because the Nylon 11 tubing is located in the Control Building in an environment that does not exceed 80 °F and a non-radioactive atmosphere, and therefore, there will be no aging effects requiring management in air-indoor and air/gas environments in the fire protection system. The staff's concern described in RAI 3.3.2.3-1 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material due to pitting and crevice corrosion for aluminum alloy material for water motor alarms exposed to an air with borated water leakage (external) environment using the External Surfaces Monitoring Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff confirmed for these AMR line items in LRA Table 3.2.2-10, in which the applicant listed the environment as air with borated water leakage, that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the "Boric Acid Corrosion Program," as recommend by GALL. The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff determined that the External Surfaces Monitoring Program which includes periodic visual inspections of external surfaces performed during system walkdowns, are adequate to manage loss of material due to general, pitting and crevice corrosion for aluminum alloy components exposed to air with borated water leakage environment addressed by this AMR.

On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, and the applicant monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material/general, pitting and crevice corrosion, loss of material/microbiologically-influenced corrosion, and loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel and ductile cast iron mechanical closure bolting in a soil (external) environment using the Bolting Integrity Program for six line items. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC, and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures which follow NRC approved guidance. Additionally, this environment consists of a mixture of inorganic materials produced by the weathering of rocks and clays, and organic material produced by the decomposition of vegetation. Water content, pH, ion exchange capacity, density, and permeability of the soil can affect degradation kinetics. TMI inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts, MIC and loss of material are also managed by the Bolting Integrity Program at a frequency defined by ASME B&PV Code, Section XI, Table IWB 2500-1, IWC 2500-1, and IWD 2500-1. Therefore, the staff concludes that the management of loss of material due to general, pitting and crevice corrosion, microbiologically-influenced corrosion and loss of preload due to thermal effects, gasket creep, and self-loosening of carbon and low alloy steel bolting and ductile cast iron mechanical closure bolting externally exposed to soil environment is acceptable.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel and ductile cast iron mechanical closure bolting in an outdoor air (external) environment using the Bolting Integrity Program for two line items. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the applicant’s Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance. Additionally, the LRA line items are similar to GALL Items VIII.H-4, and VIII.H-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air-outdoor (external) environment. This environment consists of moist air, exposure to weather, precipitation, and wind. TMI-1 inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. The staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel and ductile cast iron mechanical closure bolting in an outdoor air (external) environment is acceptable.

In LRA Table 3.3.2-10 the applicant designated Note H for stainless steel piping and fittings exposed to a soil (external) environment in the fire protection system because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. The staff reviewed the GALL Report and concluded that the AMR line item, piping and fittings is not evaluated for a soil (external) environment for loss of material due to MIC. The applicant credits the Buried Piping and Tanks Inspection Program for managing loss of material due MIC.

The staff reviewed the Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.2.15. It was noted by the staff that this program provides for opportunistic and focused excavations of stainless steel piping and fittings during the last ten years of the current license period and within ten years of the commencement of the period of extended operation. Inspection of the exposed piping will determine if microbiologically-influenced corrosion is causing loss of material. Unacceptable degradation will be corrected through the applicant’s Corrective Action Program. The staff concluded that loss of material due to microbiologically-influenced corrosion will be adequately managed through the period of extended operation because piping will be subject to inspection that will detect loss of material such that any unacceptable degradation will be corrected.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.11 Auxiliary Systems – Fuel Handling and Fuel Storage System – Summary of Aging Management Evaluation – LRA Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the fuel handling and fuel storage system component groups.

In LRA Table 3.3.2-11, the applicant stated that for Tygon® hoses in air with borated water external and treated water internal environments, there are no aging effects requiring management. The applicant referenced footnote "F" stating that this material is not listed in the GALL Report for this environment.

In RAI 3.3.2.3-1, dated October 16, 2008, the staff requested that the applicant provide additional information to justify why there are no aging effects requiring management for Tygon material. In its response to the RAI dated November 12, 2008 , the applicant stated the following:

> The Tygon tubing is used inside the Auxiliary Building as a sight hose for the fuel transfer tube drain line. Tygon tubing is made from PVC and it has excellent chemical resistance to water and to acids, including boric acid. Tygon tubing has a maximum recommended operating temperature of 165 °F and has a radiation damage threshold of 5×10^5 rads. The design temperature for the Auxiliary Building is 104 °F and the maximum radiation level at the service location is 1.3×10^4 rads in 60 years. Therefore, there are no aging effects that would result from using Tygon tubing inside the Auxiliary Building where it contacts the treated water (internal) environment and the air with borated water leakage (external) environment.

The staff reviewed the applicant response and industry documents related to Tygon material. The staff noted that Tygon material is made from PVC and is highly resistant to corrosion and can withstand temperatures up to 165 °F. The staff acknowledges that the use of Tygon material for flexible tubing in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation. On the basis that the Tygon tubing is located in the Auxiliary Building in an environment that does not exceed 104 °F and radioactive atmosphere that does not exceed 1.3×10^4 rads, the staff finds that Tygon tubing will not have any aging effects requiring management in air with boric acid leakage and treated water environments in the fuel handling and fuel storage system.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.3-1 acceptable because the use of Tygon tubing in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation and because the Tygon tubing is located in the auxiliary building in an environment that does not exceed 104 °F and radioactive atmosphere that does not exceed 1.3×10^4 rads, the Tygon tubing will not have any aging effects requiring management in air with boric acid leakage and treated water environments in the fuel handling and fuel storage system. The staff's concern described in RAI 3.3.2.3-1 is resolved.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening of stainless steel bolting externally exposed to air with borated water leakage and treated water environments using the Bolting Integrity Program for two line items. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance. Additionally, the two LRA line items are similar to GALL Item VIII.H-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air with borated water leakage (external) or treated water (external) environment. Both of these environments are potentially contaminated and could make the detection of loss of preload more difficult, as detection of leakage, one of the methods for detecting loss of preload, will be difficult to identify in these wet environments. However, TMI inspects for loss of preload using other methods as well, including inspecting for loose bolts. Therefore, the staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening of stainless steel bolting externally exposed to air with borated water leakage and treated water environments is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material/general, pitting and crevice corrosion for carbon steel crane/hoist (aux fuel handling bridge), crane/hoist (main fuel handling bridge), crane/hoist (rails), and the crane/hoist (spent fuel handling bridge) externally exposed to an air with borated water leakage environment using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program for four AMR line items. The AMR line items cite Generic Note E, which indicates that the material, aging effect, and environment are consistent with the GALL Report, however, a different aging management program is credited.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessible during plant operation and every two years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Therefore, the staff concludes that the management of loss of material/general, pitting and crevice corrosion for carbon steel crane/hoist (aux fuel handling bridge), crane/hoist (main fuel handling bridge), crane/hoist (rails), and the crane/hoist (spent fuel handling bridge) externally exposed to an air with borated water leakage environment is acceptable.

In LRA Table 3.3.2-11, the applicant proposed to manage loss of material/wear for stainless steel crane/hoist (rails) externally exposed to an air with borated water leakage environment using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.7. The LRA states that this program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. Inspection frequency is annually for cranes and hoists that are accessibly during plant operation and every two years for cranes and hoists that are only accessible during refueling outages. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance, and inspected using visual techniques. Therefore, the staff concludes that the management of loss of material/wear for stainless steel crane/hoist (rails) externally exposed to an air with borated water leakage environment is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.12 Auxiliary Systems – Fuel Oil System – Summary of Aging Management Evaluation – LRA Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the fuel oil system component groups.

In LRA Table 3.3.2-12, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel mechanical closure bolting in an outdoor air (external) environment using the Bolting Integrity Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The applicant states in the LRA that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance. Additionally, the LRA line item is similar to GALL Item VII.I-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air-outdoor (external) environment. This environment consists of moist air, exposure to weather, precipitation, and wind. TMI-1 inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. The staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening for carbon and low alloy steel mechanical closure bolting in an outdoor air (external) environment is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.13 Auxiliary Systems – Hydrogen Monitoring – Summary of Aging Management Evaluation – LRA Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the hydrogen monitoring component groups. For stainless steel piping and fittings, and stainless steel valve bodies, with an intended function of pressure boundary in an air/gas wetted (internal) environment, the applicant indicated no aging effect requiring management and no aging management program. These line items reference Note G and plant-specific Note 1, which states the following: "The internal environment for this component is air/gas (wetted), however pooling of condensation would not be present because the lines are sloped to prevent pooling per Drawing LR-302-674. Stainless steel in an air/gas internal environment without the potential for pooling condensation is equivalent to stainless steel in an air - indoor uncontrolled environment, and no aging effects are predicted for this combination per NUREG-1801, Item VII.J-15."

The staff reviewed the GALL Report and confirmed that no aging effects are predicted for stainless steel piping, piping components, and piping elements exposed to air in an indoor uncontrolled (external) environment. The staff reviewed the LRA and confirmed that line item 3.3.1-94 for stainless steel piping, piping components, and piping elements exposed to air in an indoor uncontrolled (external) environment is consistent with the GALL Report, Item VII.J-15. The staff agrees with the applicant's determination that that the two line items in LRA Table 3.3.2-13 referencing Note G, and plant-specific Note 1 are equivalent to GALL Report, Item VII.J-15, because pooling of condensation would not occur because the lines are sloped and that no aging effect is predicted and no aging management program is required.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.14 Auxiliary Systems – Instrument and Control Air System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMRs for the instrument and control air system component groups.

In LRA Table 3.3.2-14, the applicant proposed to manage reduction of heat transfer due to fouling of copper alloy with less than 15% Zinc heat exchanger components in an air/gas wetted internal environment by using the Compressed Air Monitoring Program. The applicant referenced footnote "G" for this line item indicating that the environment is not listed in the GALL Report for this material and component combination.

The staff reviewed the Compressed Air Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.8. The staff finds that during disassembly, the internals of the aftercoolers are accessible and can be visually inspected and any fouling would be observed and identified for further corrective actions. Based on this review, the staff finds that the Compressed Air Monitoring Program will adequately manage reduction of heat transfer due to fouling of copper alloy with less than 15% Zinc heat exchanger components in an air/gas wetted internal environment through the period of extended operation because periodic inspection is performed to detect any signs of degradation before loss of intended function.

In LRA Table 3.3.2-14, the applicant proposed to manage loss of material due to pitting and crevice corrosion for aluminum material for filter housing exposed to an air with borated water leakage (external) environment using the External Surfaces Monitoring Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff confirmed for these AMR line items in LRA Table 3.2.2-14, in which the applicant listed the environment as air with borated water leakage, that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program, as recommend by the GALL Report. The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Sections 3.0.3.2.16. The staff determined that the External Surfaces Monitoring Program which includes periodic visual inspections of external surfaces performed during system walkdowns, are adequate to manage loss of material due to general, pitting and crevice corrosion for aluminum components exposed to air with borated water leakage environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, and the applicant monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

In LRA Table 3.3.2-14, the applicant proposed to manage loss of preload/thermal effects, gasket creep, and self loosening for stainless steel mechanical closure bolting in an indoor air (external) and air with borated water leakage (external) environment using the Bolting Integrity Program for two AMR line items. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.3. The LRA states that this program manages the loss of material due to general, pitting and crevice corrosion, MIC and loss of preload due to thermal effects, gasket creep, and self-loosening. The staff found that the aging effects are managed through the implementation of procedures that follow NRC approved guidance. Additionally the LRA line items are similar to GALL item VIII.H-5, which accounts for an air-indoor uncontrolled (external) environment, but not an air-indoor (external) or air with borated water leakage (external) environment. Air-indoor is considered by the GALL to be synonymous with air-indoor uncontrolled. The air with borated water leakage (external) environment consists of water from leakage which is considered to be untreated, due to the potential for water contamination. TMI-1 inspects for loss of preload using methods including inspecting for leakage indicating loss of preload, and for loose bolts. The staff concludes that the management of loss of preload/thermal effects, gasket creep, and self loosening for stainless steel mechanical closure bolting in an indoor air (external) and air with borated water leakage (external) environment is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.15 Auxiliary Systems – Intake Screen and Pump House Ventilation System – Summary of Aging Management Evaluation – LRA Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarize the results of AMR evaluations for the intake screen and pump house ventilation system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.16 Auxiliary Systems – Intermediate Building Ventilation System – Summary of Aging Management Evaluation – LRA Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarize the results of AMR evaluations for the intermediate building ventilation system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.17 Auxiliary Systems – Liquid and Gas Sampling System – Summary of Aging Management Evaluation – LRA Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarize the results of AMR evaluations for the liquid and gas sampling system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.18 Auxiliary Systems – Miscellaneous Floor and Equipment Drain System – Summary of Aging Management Evaluation – LRA Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarizes the results of AMRs for the miscellaneous floor and equipment drain system component groups.

In LRA Table 3.3.2-18, the applicant stated that for organic polymer floor sumps in air/gas – wetted internal, concrete embedded, air with borated water leakage external and raw water internal environments there are no aging effects requiring management. The applicant referenced footnote "F" stating that this material is not listed in the GALL Report for these environments.

In RAI 3.3.2.3-1, dated October 16, 2008, the staff requested that the applicant provide additional information identifying what polymer material is used and to justify why there are no aging effects requiring management for this material.

In its response to the RAI dated November 12, 2008, the applicant stated the following:

> These line items refer to a fiberglass liner used inside the Tendon Access Gallery Sump. Fiberglass is a composite material comprised of glass fibers and a polyester or epoxy resin. Fiberglass composites have excellent moisture resistance and chemical resistance to many corrosive materials, including acids (specifically including boric acid), chlorides, nitrates, and sulfates. The maximum recommended operating temperature for fiberglass is

200 °F. The average normal operating temperature of the tendon access gallery is 85 °F and the radiation level is negligible. Therefore, there are no aging effects resulting from using the fiberglass sump liner inside the tendon access gallery where it contacts concrete, air with borated water leakage, air-gas wetted and raw water environments.

The staff reviewed the applicant's response and noted that fiberglass piping and liners provide excellent corrosion resistance, combined with high temperature and pressure capabilities, and it is impervious to normal plant environments. The staff acknowledges that the use of fiberglass lining inside the gallery sump in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation. On the basis that the fiberglass liner is located in the tendon access gallery sump in an environment that does not exceed 85°F and the radioactivity level is negligible, the staff finds that the fiberglass piping and liner will not have any aging effects requiring management in concrete, air with borated water leakage, air-gas wetted and raw water environments in the fuel handling and fuel storage system.

Based on its review, the staff finds the applicants response to RAI 3.3.2.3-1 acceptable because the use of fiberglass piping and lining inside the gallery sump in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation and because the fiberglass piping and liner is located in the tendon access gallery sump in an environment that does not exceed 85°F and the radioactivity level is negligible, the fiberglass piping and liner will not have any aging effects requiring management in concrete, air with borated water leakage, air-gas wetted and raw water environments in the fuel handling and fuel storage system. The staff's concern described in RAI 3.3.2.3-1 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.19 Auxiliary Systems – Open Cycle Cooling Water System – Summary of Aging Management Evaluation – LRA Table 3.3.2-19

The staff reviewed LRA Table 3.3.2-19, which summarize the results of AMR evaluations for the open cycle cooling water system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.20 Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation – LRA Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20, which summarize the results of AMR evaluations for the radiation monitoring system component groups.

The staff's review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.21 Auxiliary Systems – Radwaste System – Summary of Aging Management Evaluation – LRA Table 3.3.2-21

The staff reviewed LRA Table 3.3.2-21, which summarize the results of AMR evaluations for the radwaste system component groups.

In LRA Table 3.3.2-21, the applicant proposed to manage cracking due to stress corrosion cracking for stainless steel material for piping, fittings, eductors, heat exchanger components, pump casing, rupture disks, strainer body, tanks, thermowell and valve body components exposed to an internal environment of raw water greater than 140^{o}F using the Internal Inspection of Miscellaneous Piping and Ducting Components. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff noted that the applicant's proposed program will supplement its period visual inspections with volumetric testing to specifically manage cracking due to stress corrosion cracking in stainless steel components for indication of degradation. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections and then supplemented by volumetric test for stainless steel components to detect the aging effect of cracking due to stress corrosion cracking when exposed to an internal environment of raw water greater than 140^{o}F they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to microbiologically-influenced corrosion for copper alloy (with 15% zinc or more and with less than 15% zinc) material for pump casing, sight glasses and valve body components exposed to an internal lubricating oil environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspection, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to microbiologically-influenced corrosion and fouling for nickel alloy material for piping and fitting components exposed to an internal raw water environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections when exposed to an internal environment of raw water they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to pitting and crevice corrosion for nickel alloy material for piping and fitting components exposed to an internal treated water environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination. The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to crevice corrosion and fouling for titanium alloy material for tanks exposed to an internal raw water greater than 140°F environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note F, which indicates that the material is not addressed in the GALL Report for this environment.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material due to pitting and crevice corrosion for titanium alloy material for tanks exposed to an internal treated water greater than 140° F environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR line items cite Generic Note F, which indicates that the material is not addressed in the GALL Report for this environment.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections, they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-21, the applicant stated that for glass flow device and sight glasses in air with borated water leakage external environment there are no aging effects requiring management. The applicant referenced footnote “G” for this line item indicating that the environment is not listed in the GALL Report for this material and component combination.

As indicated in “Corrosion Handbook” by H.H.Uhlig, the staff noted that glass as a material is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since air with borated water leakage external environment does not contain hydroflouric acid or caustics. The staff reviewed the GALL Report and noted that item VII.J-12 indicates that glass in a treated borated water environment has no aging effects that require aging management. On the basis that air with borated water leakage is a less aggressive environment than treated borated water, the staff finds that glass in an air with borated water leakage will not have any aging effects requiring aging management.

In LRA Table 3.3.2-21, the applicant stated that for titanium alloy tanks in air with borated water leakage external environment there are no aging effects requiring management. The applicant referenced footnote “F” for this line item indicating that material is not listed in the GALL Report for this component and environment combination.

In RAI 3.3.2.3-1, dated October 16, 2008, the staff requested that the applicant provide additional information to justify why there are no aging effects requiring management for titanium alloy material.

In its response to the RAI dated November 12, 2008, the applicant stated the following:

> Titanium offers outstanding resistance to a wide variety of environments, including oxidizing, neutral, and inhibited reducing conditions. It also remains passive under mildly reducing conditions. Titanium is not susceptible to boric acid acorrosion, based upon corrosion testing performed by the titanium manufacturer. Based on these material

properties, titanium is not susceptible to aging effects in the air with borated water leakage environment.

The staff noted that as shown in the “Metals Handbook,” Ninth Edition, Volume 13, the corrosion resistance of titanium is a result of the formation of a continuous, stable, highly-adherent protective oxide layer on the metal surface. The staff noted that the metal itself, very reactive with a high affinity for oxygen, reforms damage to this layer instantaneously. The staff also noted that no failure due to an aging effect of titanium components in normal plant environments has been recorded in industry. Based on this review, the staff finds the applicant’s response acceptable, and finds that titanium alloy tanks in air with borated water leakage external environment will not have any aging effects requiring management.

The staff noted that for nickel alloy piping and fittings exposed to an air with borated water leakage (external) environment, the applicant assigned no aging effect and therefore no aging management program was assigned for these component/material/environment combinations.

The staff noted that austenitic materials such as nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2," April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore, the staff finds that no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.22 Auxiliary Systems – Service Building Chilled Water System – Summary of Aging Management Evaluation – LRA Table 3.3.2-22

The staff reviewed LRA Table 3.3.2-22, which summarize the results of AMR evaluations for the service building chilled water system component groups.

The staff’s evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1. The staff’s evaluation of the line item with Note I is documented in SER Section 3.3.2.1.15.

3.3.2.3.23 Auxiliary Systems – Spent Fuel Cooling System – Summary of Aging Management Evaluation – LRA Table 3.3.2-23

The staff reviewed LRA Table 3.3.2-23, which summarize the results of AMR evaluations for the spent fuel cooling system component groups.

The staff’s review did not find any line items indicating plant-specific Notes F through J whereby the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report.

The staff's evaluation of the line items with Notes A through E is documented in SER Section 3.3.2.1.

3.3.2.3.24 Auxiliary Systems – Station Blackout and UPS Diesel Generator Systems – Summary of Aging Management Evaluation – LRA Table 3.3.2-24

The staff reviewed LRA Table 3.3.2-24, which summarize the results of AMR evaluations for the station blackout and UPS diesel generator systems component groups.

In LRA Table 3.3.2-24, the applicant proposed to manage reduction of heat transfer due to fouling for carbon steel material for heat exchanger components exposed to an internal dry air/gas environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections of internal surfaces during periodic system and component surveillance activities and during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff further noted that these periodic visual inspections are adequate to manage reduction of heat transfer due to fouling for these components exposed to internal dry air/gas environment addressed by this AMR because a visual inspection will be capable of detecting any fouling (build up from whatever source) on the surface of these components. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections when exposed to an internal dry air/gas they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-24 the applicant designated Generic Note H for copper alloy piping and fittings exposed to a lubricating oil environment in the station blackout and UPS diesel generator systems (Table 3.3.2-24) because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for heat exchanger components and the staff reviewed the GALL Report and concluded that the AMR line item, copper alloy piping and fittings is not evaluated for lubricating oil for loss of material due to pitting, crevice, microbiologically-influenced corrosion. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, and microbiologically-influenced corrosion. The staff's evaluation of the Lubricating Oil Analysis Program and the One-time Inspection Program is documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff noted that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will require one-time inspection of select susceptible components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that the one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these copper alloy components through the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.25 Auxiliary Systems – Water Treatment and Distribution System – Summary of Aging Management Evaluation – LRA Table 3.3.2-25

The staff reviewed LRA Table 3.3.2-25, which summarize the results of AMR evaluations for the water treatment and distribution system component groups.

In LRA Table 3.3.2-25, the applicant proposed to manage cracking due to stress corrosion cracking for stainless steel material for pump casings exposed to an internal environment of raw water greater than 140°F using the Internal Inspection of Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff noted, that the applicant's proposed program will supplement its periodic visual inspections with volumetric testing to specifically manage cracking due to stress corrosion cracking in stainless steel components for indications of degradation. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections and then supplemented by volumetric test for stainless steel components to detect the aging effect of cracking due to stress corrosion cracking when exposed to an internal environment of raw water greater than 140°F they will be adequately managed by the Inspection of Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-25, the applicant stated that for PVC piping and fittings in raw water, treated water and air-indoor environments there are no aging effects requiring management. The applicant referenced footnote "F" for this line item indicating that material is not listed in the GALL Report for this component and environment combination.

As identified in "Engineering Materials Handbook – Engineering Plastics," the staff noted that PVC is unaffected by water, concentrated alkalis, non-oxidizing acids, oils, ozone, sunlight, or humidity changes. The staff also noted that unlike metals, thermoplastics do not display corrosion rates, and rather than depend on an oxide layer for protection, they depend on chemical resistance to the environments to which they are exposed. The use of thermoplastics in power plant environments is a design-driven criterion. The staff acknowledges that plastic is an impervious material and once selected for the environment will not have any significant age related degradation. The staff has not observed any age related industry experience for plastic material in raw water, treated water and air-indoor environments. Based on this review, the staff finds that raw water, treated water and air-indoor environments on PVC materials will not result in aging effects that will be of concern during the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the Auxiliary 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).

3.4 <u>Aging Management of Steam and Power Conversion System</u>

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion system components and component groups of the following:

- Condensate System
- Condensers and Air Removal System
- Emergency Feed water System
- Extraction Steam System
- Feed water System
- Main Generator and Auxiliary Systems
- Main Steam System
- Steam Turbine and Auxiliary Systems

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the steam and power conversion system components and component groups. In LRA Table 3.4.1, "Summary of Aging Management Evaluations for Steam and Power Conversion," the applicant provided a summary comparison of its AMRs to those evaluated in the GALL Report for steam and power conversion system components and component groups.

The applicant's AMRs evaluated and incorporated plant-specific and industry operating experience in the determination of AERMs from plant-specific condition reports and discussions with site personnel and from the GALL Report and issues identified since its publication.

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 steam and power conversion system components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMPs to ensure the applicant's claim that certain AMPs were consistent with the GALL Report. The purpose of this audit was to examine the applicant's AMPs and related documentation and to verify the applicant's claim of consistency with the corresponding GALL Report AMPs. The staff did not repeat its review of the matters described in the GALL Report. The staff's evaluations of the AMPs are documented in SER Section 3.0.3.

The staff reviewed the AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Section 3.4.2.1 and 3.4.2.2.

The staff also reviewed the AMRs not consistent with or not addressed in the GALL Report. The review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Details of the staff's evaluation are discussed in SER Section 3.4.2.3.

For components which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.4-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.4 and addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion Systems Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.4.2.2.1)
Steel piping, piping components, and piping elements exposed to steam (3.4.1-2)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.2)
Steel heat exchanger components exposed to treated water (3.4.1-3)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.2)
Steel piping, piping components, and piping elements exposed to treated water (3.4.1-4)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection, or Closed-Cycle Cooling Water System	Consistent with GALL Report (See SER Section 3.4.2.2.2)
Steel heat exchanger components exposed to treated water (3.4.1-5)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.)
Steel and stainless steel tanks exposed to treated water (3.4.1-6)	Loss of material due to general (steel only) pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry One-Time Inspection Closed-Cycle Cooling Water	Consistent with GALL Report (See SER Section 3.4.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to lubricating oil (3.4.1-7)	Loss of material due to general, pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis One-Time Inspection of steel heat exchanger components See GALL Report Item No. 3.4.1-12 below.	Not applicable to TMI-1. (See SER Section 3.4.2.2.5)
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-8)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Plant specific	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.4.2.2.3)
Stainless steel and copper alloy heat exchanger tubes exposed to treated water (3.4.1-9)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.4)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.4.1-10)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.4)
Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil (3.4.1-11)	Loss of material due to general, pitting, crevice, and micro biologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Buried Piping and Tanks Inspection program	Consistent with GALL Report (See SER Section 3.4.2.2.5)
Steel heat exchanger components exposed to lubricating oil (3.4.1-12)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, piping elements exposed to steam (3.4.1-13)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to TMI-1. (See SER Section 3.4.2.2.6.)
Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water > 60°C (> 140°F) (3.4.1-14)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.6)
Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water (3.4.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.7)
Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger components exposed to treated water (3.4.1-16)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry One-Time Inspection Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report (See SER Section 3.4.2.2.7)
Stainless steel piping, piping components, and piping elements exposed to soil (3.4.1-17)	Loss of material due to pitting and crevice corrosion	Plant specific	Yes	Buried Piping and Tanks Inspection program	Consistent with GALL Report (See SER Section 3.4.2.2.7)
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.4.1-18)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (See SER Section 3.4.2.2.7)
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil (3.4.1-19)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis One-Time Inspection Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL (See SER Section 3.4.2.2.8)

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel tanks exposed to air - outdoor (external) (3.4.1-20)	Loss of material, general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Above ground Steel Tanks	Consistent with GALL Report
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-21)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable	Not Applicable to TMI-1 (See SER Section 3.4.2.1.1)
Steel bolting and closure bolting exposed to air with steam or water leakage, air - outdoor (external), or air - indoor uncontrolled (external); (3.4.1-22)	Loss of material due to general, pitting and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	External Surfaces Monitoring Program Bolting Integrity Program	Consistent with GALL Report (See SER Section 3.4.2.1.2)
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	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1. (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	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.4.2.1.1)
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.4.1-25)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.4.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water (3.4.1-26)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.4.2.1.1)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.4.1-27)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.4.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel external surfaces exposed to air - indoor uncontrolled (external), condensation (external), or air outdoor (external) (3.4.1-28)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-29)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Flow-Accelerated Corrosion	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal) (3.4.1-30)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with GALL Report
Steel heat exchanger components exposed to raw water (3.4.1-31)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System	Consistent with GALL Report.
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.4.1-32)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.4.2.1.1)
Stainless steel heat exchanger components exposed to raw water (3.4.1-33)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System	Consistent with GALL Report.
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water (3.4.1-34)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System	Consistent with GALL Report
Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water (3.4.1-35)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water (3.4.1-36)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching	Consistent with GALL Report
Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam (3.4.1-37)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry	Consistent with GALL Report
Steel bolting and external surfaces exposed to air with borated water leakage (3.4.1-38)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Water Chemistry	Consistent with GALL Report
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	None	None	No	None	Consistent with GALL Report
Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.4.1-41)	None	None	No	None	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.4.1-42)	None	None	No	None	Not applicable to TMI-1 (See SER Section 3.4.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.4.1-43)	None	None	No	None	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.4.1-44)	None	None	No	None	Consistent with GALL Report

The staff's review of the steam and power conversion system component groups followed several approaches. One approach, documented in SER Section 3.4.2.1, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.4.2.2, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, discusses the staff's review of AMR results for components the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the steam and power conversion system components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion system components:

- Aboveground Steel Tanks
- Bolting Integrity
- Boric Acid Corrosion
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Flow Accelerated Corrosion
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- One-time Inspection
- Open Cycle Cooling Water System
- Selective Leaching of Materials
- TLAA
- Water Chemistry

LRA Tables 3.4.2-1 through 3.4.2-8 summarize the AMRs for the steam and power conversion system components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant had claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line 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 line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note 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 line items to verify consistency with the GALL Report and determined whether the AMR line 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and confirmed whether the AMR line 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. It 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 line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to verify 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 audited and 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 verify 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 ARM Results Identified as Not Applicable

Based on its initial review, the staff could not determine the specific reason why the applicant considered LRA Table 3.4.1, line items 21, 23 to 27, 32, and 42 to be not applicable. In RAI-AMR-Generic-1, dated October 16, 2008, the staff requested that the applicant provide additional information regarding these not applicable line items so the staff could complete its evaluation.

In its response to the RAI dated November 12, 2008, the applicant stated that "Not Applicable" has been used when the component, material and environment combination does not exist in the identified GALL system grouping and also when the component, material and environment combination does exist but the LRA Table 3.x.1 item was not used because a different Table 3.x.1 item was selected to manage the identified aging effect/mechanism.

Based on its review, the staff finds the applicant’s response to RAI-AMR-Generic-1 unacceptable because the applicant did not provide the specific reasons it used to consider the subject line items in LRA Table 3.1.1 not applicable and the staff could not complete its review.
In RAI-AMR-Generic-2, dated January 5, 2009, the staff requested that the applicant indicate for each of the LRA Table 3.x.1 items were "not applicable" is listed in the "discussion" column, the specific reason why the item is considered not applicable to TMI-1. The staff also requested that if the component, material and environment does exist but the LRA Table 3.x.1 item was not used, that the applicant indicate what other 3.x.1 item was selected to manage the identified aging effect/mechanism.

In its response to the RAI dated January 12, 2009, the applicant provided a table identifying the specific reason(s) why a Table 3.x.1 item is not considered applicable to TMI-1.
Based on its review, the staff finds the applicant’s response to RAI AMR-Generic-2 acceptable because the applicant provided the basis for LRA Table 3.x.1 line items identified as “not applicable.” The staff’s concern described in RAI AMR-Generic-2 is resolved.

LRA Table 3.4.1, Item 21 addresses high strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the Bolting Integrity AMP to manage cracking due to cyclic loading, stress corrosion cracking in this component group. In the applicant’s response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because there is no high-strength steel closure bolting exposed to air with steam or water leakage in steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that TMI-1 does not have support systems that are part of the steam and power conversion systems with-in the scope of license renewal that contain the high strength closure bolting fabricated from steel exposed to air with steam or water leakage. Based on its review of the LRA, the staff confirmed that there is no high-strength steel closure bolting exposed to air with steam or water leakage in steam and power conversion systems, and therefore, finds the applicant’s determination acceptable.

LRA Table 3.4.1, Item 23 addresses stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water greater than 60^{o} C (greater than 140^{o}F). The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage cracking due to stress corrosion cracking in this component group. In the applicant’s response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because there are no stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60^{o} C (greater than 140^{o}F) in steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that TMI-1 does not have support systems that are part of the steam and power conversion systems with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from stainless steel exposed to closed cycle cooling water greater than 60^o C (greater than 140^{o}F). Based on its review of the LRA, the staff confirmed that there are no stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60^o C (greater than 140^{o}F) in steam and power conversion systems, and therefore, finds the applicant's determination acceptable.

LRA Table 3.4.1, Item 24 addresses steel heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to general, pitting, crevice, and galvanic corrosion. In the applicant's response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because steel steam and power conversion systems heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system and references LRA Section 2.1.6.1. The applicant also stated that this component, material, environment, and aging effect combination is addressed by item 3.3.1-47 from the auxiliary systems grouping since galvanic corrosion as identified in item 3.4.1-24 does not apply to these heat exchanger components. Based on its review of the LRA, the staff confirmed that steel steam and power conversion systems heat exchanger components exposed to closed cycle cooling water have been included in the auxiliary systems closed cycle cooling water system. The staff also confirmed that this component, material, environment, and aging effect combination is addressed by item 3.3.1-47 from the auxiliary systems grouping since galvanic corrosion as identified in item 3.4.1-24 does not apply to these heat exchanger components. The staff finds the applicant's determination acceptable.

LRA Table 3.4.1, Item 25 addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to pitting and crevice corrosion in this component group. In the applicant's response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because there is no stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water in steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that TMI-1 does not have support systems that are part of the steam and power conversion systems with-in the scope of license renewal that contain the piping, piping components, piping elements and heat exchanger components fabricated from stainless steel exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there are no stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water in steam and power conversion systems, and therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.4.1, Item 26 addresses copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage loss of material due to pitting, crevice, and galvanic corrosion in this component group. In the applicant's response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because there is no copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water in steam and power conversion system. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that TMI-1 does not have support systems that are part of the steam and power conversion systems with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from copper alloy exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there is no copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water in steam and power conversion systems, and therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.4.1, Item 27 addresses steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water. The GALL Report recommends the Closed Cycle Cooling Water System AMP to manage reduction of heat transfer due to fouling in this component group. In the applicant's response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because there is no steel, stainless steel, or copper alloy heat exchanger tubes exposed to closed cycle cooling water with an intended function of heat transfer in steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that TMI-1 does not have support systems that are part of the steam and power conversion systems with-in the scope of license renewal that contain the heat exchanger tubes fabricated from steel, stainless steel and copper alloy exposed to closed cycle cooling water. Based on its review of the LRA, the staff confirmed that there is no steel, stainless steel, or copper alloy heat exchanger tubes exposed to closed cycle cooling water with an intended function of heat transfer in steam and power conversion systems, and therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.4.1, Item 32 addresses stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water. The GALL Report recommends the Open Cycle Cooling Water System AMP to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion in this component group. In the applicant's response to RAI-AMR-Generic-2, the applicant stated that this line item is not applicable because it predicts the additional aging effect/mechanism of loss of material/fouling for stainless steel in raw water. The applicant also stated that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-33. Based on its review of the LRA, the staff confirmed that the applicant predicts the additional aging effect/mechanism of loss of material/fouling for stainless steel in raw water and also confirmed that this component, material, environment, and aging effect/mechanism combination is addressed by item 3.4.1-33. The staff finds the applicant's determination acceptable.

LRA Table 3.4.1, Item 42 addresses steel piping, piping components, and piping element exposed to air – indoor controlled (external). The GALL Report does not recommend an AMP as there is no aging effect/mechanism in this component group. In the LRA, the applicant stated that indoor air (controlled) environment is not used for steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that TMI-1 does not have support systems that are part of the steam and power conversion systems with-in the scope of license renewal that contain the piping, piping components and piping elements fabricated from steel exposed to air – indoor controlled (external). Based on its review of the LRA, the staff confirmed that indoor air (controlled) environment is not used for steam and power conversion systems, and, therefore, the staff finds the applicant's determination acceptable.

3.4.2.1.2 Loss Of Material due to General, Pitting and Crevice Corrosion; Loss Of Preload Due to Thermal Effects, Gasket Creep, and Self-Loosening

LRA Table 3.4.1, Item 3.4.1-22 addresses loss of material due to general, pitting and crevice corrosion for steel components with its external surfaces exposed to outdoor air in the Condensate System.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for steel piping, fittings and valve body components in an outdoor air (external) environment only. The

GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff noted from its review that the AMR line items that the referenced Item 3.4.1-22 and credited the External Surfaces Monitoring Program are not bolting components with an intended function for mechanical closure. The staff further noted that the applicant referenced Item 3.4.1-22 of LRA Table 3.4.1 because there was not another applicable Table 1 line item in LRA Table 3.4.1 that corresponded to the same material, environment and aging effect combination.

The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walk downs, is adequate to manage loss of material due to general, pitting and crevice corrosion for steel components exposed to outdoor air (external) addressed by this AMR. On the basis of periodic visual inspections being performed during system walk downs of these components, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

LRA Table 3.4.1, Item 3.4.1-22 addresses loss of material due to general, pitting and crevice corrosion for steel components with their external surfaces exposed to outdoor air or uncontrolled indoor air in the feed water system, the emergency feed water system and the main steam system. The staff noted that for those AMR line items in LRA Section 3.4 in which the applicant references Item 3.4.1-22, the applicant listed the environment as air with borated water leakage, which is a more aggressive environment, compared to outdoor air or uncontrolled indoor air. The staff confirmed in LRA Section 3.4 that for the same system, component, material and environment combination, the applicant manages loss of material due to boric acid corrosion with the Boric Acid Corrosion Program, as recommend by the GALL Report.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for steel piping, fittings and valve body components in an air with borated water leakage environment only. The GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited.

The staff reviewed the applicant's External Surfaces Monitoring program and its evaluation is documented in SER Section 3.0.3.2.16. The staff noted from its review that all AMR line items that the referenced Item 3.4.1-21 and credited the External Surfaces Monitoring Program are not bolting components with an intended function for mechanical closure. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walk downs, is adequate to manage loss of material due to general, pitting and crevice corrosion for steel components exposed to air with borated water leakage environment addressed by this AMR. On the basis of periodic visual inspections being performed during system walk downs of these components by the External Surfaces Monitoring Program, and the applicant monitoring these components with the Boric Acid Corrosion Program, for loss of material due to boric acid corrosion, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

Based on a review of the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.1.3 Loss of Material due to Pitting and Crevice Corrosion

LRA Table 3.5.1, Item 3.5.1-50 addresses loss of material due to pitting and crevice corrosion for stainless steel components with their external surfaces exposed to outdoor air in the condensate system. The staff noted that the applicant referenced Item 3.5.1-50 of LRA Table 3.5.1 because there was not an applicable Table 1 line item in LRA Table 3.4.1 that corresponded to the same material, environment and aging effect combination.

The LRA credits the External Surfaces Monitoring Program to manage this aging effect for stainless steel piping, fittings and valve body components in an outdoor air (external) environment only. The GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff confirmed that only components that align to GALL Item III.B2-7 and are fabricated from stainless steel materials, are applicable to TMI-1.

The staff reviewed the External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.16. The staff finds that the External Surfaces Monitoring Program, which include periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel components exposed to outdoor air (external) addressed by this AMR. On the basis of periodic visual inspections being performed during system walkdowns of these components, the staff finds the applicant's use of the External Surfaces Monitoring program acceptable.

Based on a review of the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

LRA Section 3.4.2.2 provides further evaluation of aging management, as recommended by the GALL Report for the steam and power conversion system components. The applicant provided information concerning how it will manage the following aging effects:

- Cumulative Fatigue Damage
- Loss of Material due to General, Pitting, and Crevice Corrosion
- Loss of Material due to General, Pitting, Crevice, MIC, and Fouling
- Reduction of Heat Transfer due to Fouling
- Loss of Material due to General, Pitting, Crevice, and MIC

- Cracking due to SCC
- Loss of Material due to Pitting and Crevice Corrosion
- Loss of Material due to Pitting, Crevice, and MIC
- Loss of Material due to General, Pitting, Crevice, and Galvanic Corrosion

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluations to determine whether they adequately address those issues and reviewed the applicant's further evaluations against the criteria in SRP-LR Section 3.4.2.2. The staff's review of the applicant's further evaluations follows.

3.4.2.2.1 Cumulative Fatigue Damage

LRA Section 3.4.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3. An applicant must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.4.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.

(1) LRA Section 3.4.2.2.2.1 addresses loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water or steam in the auxiliary steam system, condensate system, condensers and air removal system, emergency feedwater system, extraction steam system, feedwater system, liquid and gas sampling system, main steam system, makeup and purification system (high pressure injection), miscellaneous floor and equipment drains system, steam turbine and auxiliary system, and water treatment and distribution system. The applicant stated that the aging effect of loss of material due to general, pitting and crevice corrosion in these components will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program. The applicant also stated that loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements, and tanks exposed to treated water in the closed-cycle cooling water system will be managed by the Closed-Cycle Cooling Water System Program.

The staff reviewed LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2, which states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The SRP-LR states that the existing AMP relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion, but that control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be confirmed to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. The SRP-LR states that a one-time inspection of selected components and susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection program. The staff's evaluation of this program, which is documented in SER Section 3.0.3.2.14, determined that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material in susceptible locations due to general, pitting, and crevice corrosion for components within the scope of the program. Based on the staff's determination that the applicant's Water Chemistry program provides mitigation and the applicant's One-Time Inspection Program provides detection for the potential aging effect of loss of material due to general, pitting, and crevice corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water or steam in the auxiliary steam system, condensate system, condensers and air removal system, emergency feedwater system, extraction steam system, feedwater system, liquid and gas sampling system, main steam system, makeup and purification system (high pressure injection), miscellaneous floor and equipment drains system, steam turbine and auxiliary system, and water treatment and distribution system to be acceptable.

The staff noted that in LRA Table 3.3.2-4 (LRA pages 3.3-154 and -159) the applicant included two (2) AMR result lines referring to LRA Table 3.4.1, item 3.4.1-4, for carbon steel piping and fittings and for valve bodies exposed to treated water in the closed cycle cooling water system. For these components, the applicant stated that the aging effect of loss of material due to general, pitting, and crevice corrosion will be managed by the Closed-Cycle Cooling Water System Program and cited generic note E, indicating that the AMR result is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff reviewed the applicant's Closed-Cycle Cooling Water System Program and its evaluation is documented in SER Section 3.0.3.2.6. The staff finds that the Closed-Cycle Cooling Water System Program, when enhanced, is consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water." The staff found that the applicant's Closed-Cycle Cooling Water System Program includes preventive actions to minimize corrosion and periodic inspection activities to detect corrosion. Because the AMP includes both preventive actions and inspection activities, the staff finds that the applicant's use of the Closed-Cycle Cooling Water System Program for managing the aging effect of loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements and valves exposed to treated water in the closed cooling water system to be acceptable.

(2) LRA Section 3.4.2.2.2 addresses the loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to lubricating oil stating that line item number 3.4.1-7 is not applicable to TMI-1. The LRA also states that the lubricating oil environment in the steam and power conversion system includes the additional aging mechanism of MIC and that Table 1 item number 3.4.1-12 applies.

The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring.

The staff compared SRP-LR Sections 3.4.2.2.2 and 3.4.2.2.5 and noted that both sections provide for management of loss of material due to general, pitting and crevice corrosion in steel components by controlling contaminants and a verification of effectiveness, in which the applicant will utilize its Lubricating Oil Analysis Program and verify the effectiveness of the Lubricating Oil Analysis Program with the One-Time Inspection Program. The staff noted that steel piping, piping components, and piping elements exposed to lubricating oil are part of the scope of LRA Section 3.4.2.2.5 and therefore general, pitting and crevice corrosion will be managed in accordance with GALL Report recommendations through the period of extended operation.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and 2) will provide for one-time inspections of select steel components exposed to lubricating oil for loss of material due to general, pitting and crevice corrosion at susceptible locations to verify the effectiveness of the applicant’s Lubricating Oil Analysis Program in applicable Steam and Power systems. Therefore, the staff finds that, based on a review of the programs identified above, the criteria of SRP-LR Section 3.4.2.2.2 is satisfied.

Based on the staff’s review and evaluation of the applicant’s programs, the staff concludes that the applicant’s programs satisfy SRP-LR Section 3.4.2.2.2 criteria. For those line items that apply to LRA Section 3.4.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material due to General, Pitting, Crevice, and MIC, and Fouling

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

LRA Section 3.4.2.2.3 addresses loss of material due to general, pitting, crevice, microbiologically-influenced corrosion and fouling in steel piping, piping components and piping elements exposed to raw water.

SRP-LR Section 3.4.2.2.3 states that loss of material due to general, pitting, crevice, microbiologically-influenced corrosion and fouling may occur in steel piping, piping components and piping elements exposed to raw water. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in steel internal surfaces exposed to internal raw water.

The GALL Report, under Item VIII.G-36 recommends that a plant-specific program be credited to manage this aging effect for steel piping, piping components and piping elements in the Steam and Power Conversion Systems.

The staff confirmed that only piping, fittings and tanks that align to GALL AMR VIII.G-36 for the Reactor Building Sump and Drain System and the Radwaste System that are fabricated from steel materials are applicable to TMI that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that these systems, in which the applicant has referenced Item VII.G-36, are not part of the Steam and Power Conversion Systems. The systems were grouped together with this GALL AMR item because the material, environment, and aging effect combination corresponded. The staff confirmed, as stated in the LRA, that there are no steel piping, piping components and piping elements exposed to raw water in the steam and power conversion systems.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are adequate to manage loss of material due to general, pitting, crevice, microbiologically-influenced corrosion and fouling in steel piping, piping components and piping elements exposed to raw water on the internal surface.

Based on the staff’s review and evaluation of the applicant’s program, the staff concludes that the applicant’s program meets SRP-LR Section 3.4.2.2.3 criteria and, therefore, the applicant’s AMRs are consistent with those under GALL Report Items VII.G-36. For those line items that apply to LRA Section 3.4.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.4 Reduction of Heat Transfer due to Fouling

The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4.

(1) LRA Section 3.4.2.2.4 addresses the applicant’s aging management basis for managing reduction of heat transfer due to fouling in stainless steel heat exchanger components exposed to treated water in the condenser and air removal system. The applicant stated that the aging effect of reduction of heat transfer due to fouling in these components will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program.

    The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4, which states that reduction of heat transfer due to fouling may occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The SRP-LR states that the existing aging management program relies on control of water chemistry to manage reduction of heat transfer due to fouling, but control of water chemistry may not always have been adequate to preclude fouling. The GALL Report recommends that the effectiveness of the water chemistry control program should be confirmed to ensure that reduction of heat transfer due to fouling is not occurring. The SRP-LR states that a one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component’s intended function will be maintained during the period of extended operation.

The staff reviewed the Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of heat exchanger tube fouling that might result in reduction of heat transfer for components within the scope of the program. Based on the staff's determination that the applicant's Water Chemistry Program provides mitigation and the applicant's One-Time Inspection Program provides detection for the potential aging effect of reduction in heat transfer due to heat exchanger tube fouling, the staff finds the applicant's proposed AMPs for managing the aging effect of reduction of heat transfer due to fouling in stainless steel heat exchanger components exposed to treated water in the condenser and air removal system to be acceptable.

(2) LRA Section 3.4.2.2.4 states that the One-Time Inspection Program will be implemented to verify the effectiveness of the Lubricating Oil Analysis Program, B.2.1.23, to manage the reduction of heat transfer due to fouling in steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil in the closed cycle cooling water system, emergency diesel generators and auxiliary systems, and station blackout and uninterruptable power supply (UPS) diesel generator systems.

The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4, which states that reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. Furthermore, the existing aging management program relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control program. SRP-LR states a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of heat transfer due to fouling and 2) will provide for one-time inspections of select steel, stainless steel and copper alloy heat exchanger tubing exposed to lubricating oil for loss of heat transfer due to fouling at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program in applicable steam and power conversion systems.

Based on the staff's review and evaluation of the applicant's programs, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4 criteria. For those line items that apply to LRA Section 3.4.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and MIC

The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5.

(1) LRA Section 3.4.2.2.5 states the Buried Piping and Tanks Inspection Program will be implemented to manage the loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion in steel piping, piping components, piping elements, and tanks exposed to soil in the condensate system and the emergency diesel generators and auxiliary system.

The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5, which states that loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. Furthermore, the effectiveness of the buried piping and tanks inspection program should be confirmed to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The staff reviewed the Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.2.15. The staff finds that this program provides focused or opportunistic excavations and inspections for general, pitting, crevice, and microbiologically-influenced corrosion of buried steel piping and tanks within ten years before the period of extended operation and within ten years after the initiation of the period of operation except for the buried diesel generator fuel storage 30,000 gallon tank where ultrasonic testing of the tank walls will be performed from the inside of the tank to verify acceptable wall thickness. Therefore, the staff finds that, based on a review of the program identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.5.

(2) LRA Section 3.4.2.2.5 states the One-Time Inspection Program will be implemented for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the loss of material due to general, pitting, crevice, and MIC in steel, piping, piping components, piping elements, tanks, and heat exchanger components exposed to lubricating oil in the closed cycle cooling water system, condensate system, condensers & air removal system, emergency diesel generators and auxiliary systems, emergency feedwater system, feedwater system, main generator and auxiliary systems, makeup and purification system (high pressure injection), reactor coolant system, station blackout and UPS diesel generator systems, and steam turbine and auxiliary systems.

The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5, which states that loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel heat exchanger components exposed to lubricating oil. Furthermore the existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. SRP-LR Section 3.4.2.2.5 states the effectiveness of lubricating oil contaminant control can be achieved through a one-time inspection of selected components at susceptible locations.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select steel heat exchanger tubing exposed to lubricating oil for loss of heat transfer due to fouling at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program in applicable Steam and Power Conversion systems.

LRA Section 3.4.2.2.5 addresses loss of material due to general, pitting, crevice and microbiologically-influenced corrosion in steel heat exchanger components exposed to lubricating oil. The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5, which states that loss of material due to general, pitting, crevice and microbiologically-influenced corrosion may occur in steel heat exchanger components exposed to lubricating oil. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in steel internal surfaces exposed to lubricating oil.

The GALL Report, under Item VIII.G-6 recommends that the Lubricating Oil Analysis Program be credited to manage this aging effect and that a plant-specific AMP be evaluated and credited to verify that the Lubricating Oil Analysis Program is achieving its mitigative function to manage loss of material due to general, pitting, crevice and microbiologically-influenced corrosion for steel heat exchanger components. These GALL Report AMRs identify a One-Time Inspection Program as an acceptable AMP to credit for the verification of the effectiveness of the Lubricating Oil Analysis Program.

The staff confirmed that only piping, fittings, tanks and valve bodies that align to GALL AMRs VIII.G-6 for the Radwaste System that are fabricated from steel materials are applicable to TMI-1 that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the radwaste system which the applicant has referenced in Item VIII.G-6 is not a part of the steam and power conversion systems, but was grouped together with this AMR GALL item because the material, environment, and aging effect combination corresponded.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are adequate to manage loss of material due to general, pitting, crevice and microbiologically-influenced corrosion in steel heat exchanger components exposed to lubricating oil.

Based on the staff’s review and evaluation of the applicant’s program, the staff concludes that the applicant’s program meets SRP-LR Section 3.4.2.2.5 criteria. For those line items that apply to LRA Section 3.4.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.6 Cracking due to SCC

The staff reviewed LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6.

LRA Section 3.4.2.2.6 addresses cracking due to stress corrosion cracking, stating that line item 3.4.1-13 is applicable to BWRs only and is not used for TMI-1, which is a PWR. This item pertains to SCC in stainless steel piping, piping components, and piping elements exposed to steam. TMI-1 is a PWR. The staff agrees that this line item is not applicable to TMI-1.

LRA Section 3.4.2.2.6 states that TMI-1 will implement a One-Time Inspection Program, for susceptible locations to verify the effectiveness of the Water Chemistry Program to manage cracking due to stress corrosion cracking in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to treated water greater than 60^{o} C (greater than 140^{o} F) in the auxiliary steam system, closed cycle cooling water system, condensate system, extraction steam system, feedwater system, liquid and gas sampling system, main generator and auxiliary systems, main steam system, and steam turbine and auxiliary systems.

The staff reviewed LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6 which states that SCC may occur in stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60 °C (140 °F). The SRP-LR also states that the existing aging management program relies on monitoring and control of water chemistry to manage the effects of cracking due to SCC, however, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. The GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring and that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the AMR result line referencing LRA Table 3.4.1, item 3.4.1-14. The staff noted that the applicant proposed to manage the aging effect of cracking due to stress corrosion cracking using a combination of the Water Chemistry Program and the One-Time Inspection Program for this line item.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the Water Chemistry Program, with an enhancement, is consistent with GALL AMR XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence of cracking due to stress corrosion cracking for components within its scope. Based on the staff's determination that the applicant's Water Chemistry Program provides mitigation and the applicant's One-Time Inspection Program provides detection for the potential aging effect of cracking due to stress corrosion cracking, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to stress corrosion cracking in stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60 °C (140 °F) acceptable.

Based on the staff's review and evaluation of the applicant's programs, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.6 criteria. For those line items that apply to LRA Section 3.4.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.7 Loss of Material due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.7 against the criteria in SRP-LR Section 3.4.2.2.7.

(1) LRA Section 3.4.2.2.7 addresses the applicant's aging management basis for managing loss of material due to pitting and crevice corrosion in aluminum and copper alloy piping, piping components and piping elements exposed to treated water, and in stainless steel piping, piping components, and piping elements, tanks, and heat exchanger components exposed to treated water in the steam and power conversion system. The applicant stated that the aging effect of loss of material due to pitting and crevice corrosion will be managed by a combination of the Water Chemistry program and the One-Time Inspection Program. The applicant also stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be used to manage the aging effect of loss of material due to pitting and crevice corrosion in stainless steel piping, piping components and piping elements exposed to treated water in the circulating water system.

The staff reviewed LRA Section 3.4.2.2.7 against the criteria in SRP-LR Section 3.4.2.2.7, which states that loss of material due to pitting and crevice corrosion may occur for stainless steel, aluminum, and copper alloy piping, piping components and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. SRP-LR Section 3.4.2.2.7 states that the existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion; however, control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. The GALL Report recommends that the effectiveness of the water chemistry program should be confirmed to ensure that corrosion is not occurring. SRP-LR Section 3.4.2.2.7 states that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The staff reviewed the AMR results lines referencing to LRA Table 3.4.1, items 3.4.1-15 and 3.4.1-16. The staff noted that the applicant proposed to manage the aging effect of loss of material due to pitting and crevice corrosion using a combination of the Water Chemistry Program and the One-Time Inspection Program for all components referencing items 3.4.1-15 and 3.4.1-16 except for stainless steel valve bodies in the circulating water system. For stainless steel valve bodies in the circulating water system the staff noted that the applicant proposed to manage the aging effect of loss of material due to pitting and crevice corrosion using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the Water Chemistry Program, with an enhancement, is consistent with GALL AMR XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material due to pitting and crevice corrosion in susceptible locations for components within its scope. Based on the staff's determination that the applicant's Water Chemistry Program provides mitigation and the applicant's One-Time Inspection Program provides detection for the potential aging effect of loss of material due to pitting and crevice corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to pitting and crevice corrosion in aluminum alloy, copper alloy, and stainless steel piping, piping components, piping elements, tanks, and heat exchangers components exposed to treated water in the steam and power conversion system acceptable.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the applicant's AMP is consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," with an acceptable exception. The staff's evaluation determined that the applicant's AMP provides for internal inspection of components during periodic system and component surveillances or during routine maintenance activities, that the inspections are adequate to detect the presence or note the absence of loss of material due to pitting and crevice corrosion for components within its scope, and that if degraded conditions are found the program requires evaluation and corrective actions in accordance with the applicant's quality assurance program. On the basis that the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is capable of detecting the aging effect of loss of material due to pitting and crevice corrosion and requires corrective actions if degraded conditions are found, the staff finds the applicant's proposed AMP for managing loss of material due to pitting and crevice corrosion in stainless valve bodies exposed to treated water in the circulating water system acceptable.

LRA Section 3.4.2.2.7 addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, tanks and heat exchanger components exposed to treated water. The staff reviewed LRA Section 3.4.2.2.7 against the criteria in SRP-LR Section 3.4.2.2.7, which states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, piping elements, tanks and heat exchanger components exposed to treated water. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage this aging effect in stainless steel components exposed to treated water.

The GALL report, under Items VIII.E-4, VIII.E-36, VIII.F-27, VIII.B1-4, VIII.C-1, VIII.D1-4, VIII.D2-4, VIII.E-29, VIII.F-23 and VIII.G-32 and SRP-LR Section 3.4.2.2.7 Item No. 1 recommends that Water Chemistry Program be credited to manage this aging effect and that a plant-specific AMP be evaluated and credited to verify that the Water Chemistry Program is achieving its mitigative function to manage loss of material due to pitting and crevice corrosion for stainless steel piping and piping components and elements. These GALL AMRs identify a one-time inspection program is an acceptable AMP to credit for the verification of the effectiveness of the Water Chemistry Program.

The staff confirmed that only valve bodies that align to GALL AMRs VIII.B1-4 for the Circulating Water System that are fabricated from stainless steel materials are applicable to TMI that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that are adequate to manage loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, tanks and heat exchanger components exposed to treated water.

(2) LRA Section 3.4.2.2.7 states that a Buried Piping and Tanks Inspection program, will be implemented to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to soil in the condensate system. The applicant's Buried Piping and Tanks Inspection Program includes preventive measures to mitigate corrosion such as the use of external coatings and wrappings, and it includes periodic inspection of external surfaces for loss of material to manage the effects of corrosion on the pressure-retaining capacity of piping and components in a soil (external) environment, which are in accordance with standard industry practices.

The staff reviewed LRA Section 3.4.2.2.7 against the criteria in SRP-LR Section 3.4.2.2.7, which states that states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant specific aging management program to ensure that this aging effect is adequately managed and acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR.)

In the discussion column of LRA Table 3.4.2-1, the applicant stated that loss of material of stainless steel piping exposed to the buried (external) environment is managed with Buried Piping and Tank Inspection Program. The staff noted that for the AMR results line that references LRA Table 3.4.2-1, the applicant included a reference to Note E. The staff reviewed the AMR results line referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends a plant specific program, the applicant has proposed using the Buried Piping and Tank Inspection Program.

The staff reviewed the Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.2.15. The staff finds that this program will provide planned inspections within ten years from entering the period of extended operation unless an opportunistic inspection has occurred within this ten-year period for stainless steel components exposed to soil for loss of material due to pitting and crevice corrosion in condensate system (the gland steam condenser is evaluated with the condensate system). The Buried Piping and Tanks Inspection Program is in accordance with the recommendations of GALL AMP XI.M34 "Buried Piping and Tanks Inspection." The staff noted that although GALL AMP XI.M34 cites applicability to only steel and gray cast iron components, stainless steel components in the scope of this program will also be adequately managed for loss of material because excavation of stainless steel components and subsequent visual inspection will detect any loss of material due to pitting and crevice corrosion.

(3) LRA Section 3.4.2.2.7 states that a One-Time Inspection Program, will be implemented for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements exposed to lubricating oil in the condensers & air

removal system, emergency feedwater system, feedwater system, and main generator and auxiliary systems.

The staff reviewed LRA Section 3.4.2.2.7 against the criteria in SRP-LR Section 3.4.2.2.7, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. Furthermore, the existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. SRP-LR Section 3.4.2.2.7 states the effectiveness of lubricating oil contaminant control can be confirmed through a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting and corrosion and 2) will provide for one-time inspections of select copper alloy piping, piping components, and piping elements exposed to lubricating oil for loss of material due to pitting and crevice corrosion at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program in applicable Steam and Power Conversion systems.

Based on the staff's review and evaluation of the applicant's programs, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7 criteria. For those line items that apply to LRA Section 3.4.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material due to Pitting, Crevice, and MIC

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8.

LRA Section 3.4.2.2.8 addresses loss of material due to pitting, crevice and microbiologically-influenced corrosion in stainless steel piping, piping components, piping elements and heat exchanger components exposed to lubricating oil.

SRP-LR Section 3.4.2.2.8 which states that loss of material due to pitting, crevice and microbiologically-influenced corrosion, may occur in stainless steel piping, piping components, piping elements and heat exchanger components exposed to lubricating oil.

The GALL report, under Items VIII.G-3, VIII.A-9, VIII.D1-3, VIII.D2-3, VIII.E-26 and VIII.G-29 recommends that Lubricating Oil Analysis Program be credited to manage this aging effect and that a plant-specific AMP be evaluated and credited to verify that the Lubricating Oil Analysis Program is achieving its mitigative function to manage loss of material due to pitting, crevice and microbiologically-influenced corrosion for stainless steel piping and piping components and elements and heat exchanger components. These GALL AMRs identify a One-Time Inspection Program as an acceptable AMP to credit for the verification of the effectiveness of the Lubricating Oil Analysis Program.

The staff confirmed that only piping and fittings that align to GALL AMRs VIII.E-26 for the Instrument and Control Air System that are fabricated from stainless steel materials are applicable to TMI that credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspections of internal surfaces of components during periodic system and component surveillance activities or during maintenance activities when the internal surface becomes accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that this program includes activities that is adequate to manage loss of material due to pitting, crevice and microbiologically-influenced corrosion in stainless steel piping, piping components, piping elements and heat exchanger components exposed to lubricating oil.

LRA Section 3.4.2.2.8 states that a One-Time Inspection program, B.2.1.18, will be implemented for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program, to manage the loss of material due to pitting, crevice, and microbiologically-influenced corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to lubricating oil in the condensers & air removal system, emergency feedwater system, feedwater system, and steam turbine and auxiliary systems.

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8, which states that loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. Furthermore, the existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. SRP-LR Section 3.4.2.2.8 states the effectiveness of lubricating oil contaminant control can be confirmed through a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring.

The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select stainless steel piping, piping components, piping elements exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program in applicable Steam and Power Conversion systems.

Based on the staff's review and evaluation of the applicant's programs, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.8 criteria. For those line items that apply to LRA Section 3.4.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material due to General, Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9.

LRA Section 3.4.2.2.9 addresses the applicant's aging management basis for managing loss of material due to general, pitting, crevice, and galvanic corrosion in steel heat exchanger components exposed to treated water in the condensers and air removal system. The applicant stated that the aging effect of loss of material due to general, pitting, crevice and galvanic corrosion in these components will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program. The applicant also stated that the aging effect of loss of material due to general, pitting and crevice corrosion in steel heat exchanger components in the feedwater system will be managed by a combination of the Water Chemistry Program and the One-Time Inspection Program; however, the applicant stated that the aging mechanism of galvanic corrosion does not apply to the feedwater system high pressure heaters since pressure boundary and leakage boundary components are not in contact with materials higher in galvanic series.

SRP-LR Section 3.4.2.2.9 states that loss of material due to general, pitting, crevice, and galvanic corrosion may occur in steel heat exchanger components exposed to treated water. SRP-LR Section 3.4.2.2.9 states that the existing AMP relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion, but control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be confirmed to ensure that corrosion does not occur. The GALL Report recommends that the effectiveness of water chemistry should be confirmed to confirm that corrosion does not occur. SRP-LR Section 3.4.2.2.9 states that a one-time inspection of selected components and susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

In evaluating the applicant's proposed AMPs, the staff noted that in LRA Table 3.4.1, Item 3.4.1-5, the applicant stated that the result is not consistent with the GALL Report. The staff also noted that for AMR results in LRA Table 3.4.2-5 that refers to Item 3.4.1-5, the applicant cited Generic Note I, indicating that the aging effect in the GALL Report is not applicable for the component, material and environment combination in the applicant's AMR result. The staff noted that the applicant had determined the aging mechanism of galvanic corrosion not to be applicable for the in-scope (pressure and leakage boundary) components in the feedwater system high pressure heaters.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the applicant's One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of loss of material due to general, pitting, crevice, and galvanic corrosion in susceptible locations for components within the scope of the program. Based on the staff's determination that the applicant's Water Chemistry Program provides mitigation and the applicant's One-Time Inspection Program provides detection for the potential aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion, the staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to general, pitting, crevice, and galvanic corrosion in steel heat exchanger components exposed to treated water in the condensers and air removal system to be acceptable. The staff finds the applicant's proposed AMPs for managing the aging effect of loss of material due to general, pitting, and crevice corrosion in steel heat exchanger components in the feedwater system to be acceptable.

Based on the staff's review and evaluation of the applicant's programs, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.9 criteria. For those lines that apply to LRA Section 3.4.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's QA program.

3.4.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-8, the staff reviewed additional details of 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 3.4.2-8, the applicant indicated, via 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 concerning how the aging effects will be managed. 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 had demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.4.2.3.1 Steam and Power Conversion System – Condensate System – Summary of Aging Management Evaluation – LRA Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMRs for the condensate system component groups.

In LRA Table 3.4.2-1, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) for piping and fittings and valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water (internal) using the Water Chemistry Program and the One-Time Inspection Program. For these components the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for copper alloy with 15% or greater zinc in a treated water environment with ammonia present include cracking due to SCC.

The staff confirmed that the GALL Report does not list cracking due to SCC as an aging effect applicable for copper alloy with 15% or greater zinc exposed to treated water. The staff also reviewed selected portions of EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006. The staff noted that Section 3.2.2, Appendix A of the EPRI report states that in the presence of ammonia or other ammonium compounds that may be in used in treated water systems, cracking due to SCC can occur in copper alloys containing 15% or greater zinc. On the basis that the aging effect is identified in the EPRI report, the staff finds the applicant's identification of cracking due to SCC in copper components exposed to treated water acceptable.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the applicant's One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of cracking due to SCC for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of cracking due to SCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC in piping and fittings and in valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water in the condensate system acceptable.

In LRA Table 3.4.2-1, the applicant designated Generic Note H for stainless steel piping and fittings exposed to a soil (external) environment in the condensate system because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. The staff reviewed the GALL Report and found that the AMR line item, piping and fittings were not evaluated for a soil (external) environment for loss of material due to microbiologically influence corrosion. The applicant credits the Buried Piping and Tanks Inspection Program for managing loss of material due to microbiologically-influenced corrosion. The staff reviewed the Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.2.15. The applicant's program provides for opportunistic and focused excavations of stainless steel piping and fittings during the last ten years of the current license period and within ten years after the commencement of the period of extended operation. The applicant's program also provides for inspection of the exposed piping and fittings that will determine if microbiologically-influenced corrosion is causing loss of material. Unacceptable degradation will be corrected through the applicant's Corrective Action Program. The staff determines that loss of material due to microbiologically-influenced corrosion of stainless steel piping and fittings exposed to soil will be adequately managed through the period of extended operation because piping will be subject to inspection that will detect loss of material such that any unacceptable degradation will be corrected.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Steam and Power Conversion System – Condensers and Air Removal System – Summary of Aging Management Evaluation – LRA Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the condensers & air removal system component groups.

The applicant designated Note G for aluminum alloy filter housings and Note H for copper alloy (Zn less than 15%) piping and fittings exposed to a lubricating oil environment in the condensers & air removal system because the loss of material due to the mechanism of microbiologically-influenced corrosion for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for the copper piping and fittings and the environment is not in the GALL Report for the aluminum alloy filter housings. The staff reviewed the GALL Report and found that the AMR line item, piping and fittings is not evaluated for a lubricating oil environment for loss of material due to microbiologically-influenced corrosion and accordingly Note H is appropriate and that the GALL Report does not address aluminum filter housings exposed to lubricating oil and accordingly Note G is appropriate. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, and MIC. The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these aluminum and copper alloy components exposed to lubricating oil through the period of extended operation.

In LRA Table 3.4.2-2, the applicant stated that for glass flow device and sight glasses in air-gas wetted internal environment there are no aging effects requiring management. The applicant referenced footnote “G” for this line item indicating that environment is not listed in the GALL Report for this material and component combination.

As indicated in “Corrosion Handbook” by H.H.Uhlig, the staff noted that glass as a material is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since air-gas wetted internal environment does not contain hydroflouric acid or caustics. Based on this review and on the industry operating experience, the staff finds that glass in an air-gas wetted internal environment will not have any aging effects requiring aging management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL

Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 Steam and Power Conversion System – Emergency Feedwater System – Summary of Aging Management Evaluation – LRA Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarizes the results of AMRs for the emergency feedwater system component groups.

In LRA Table 3.4.2-3, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) for valve bodies and flow devices made of copper alloy with 15% or greater zinc exposed to an environment of treated water (internal) using the Water Chemistry Program and the One-Time Inspection Program. For these components the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for copper alloy with 15% or greater zinc in a treated water environment include cracking due to SCC.

The staff confirmed that the GALL Report does not list cracking due to SCC as an aging effect applicable for copper alloy with 15% or greater zinc exposed to treated water. The staff also reviewed selected portions of EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006. The staff noted that Section 3.2.2, Appendix A of the EPRI report states that in the presence of ammonia or other ammonium compounds that may be in used in treated water systems, cracking due to SCC can occur in copper alloys containing 15% or greater zinc. On the basis that the aging effect is identified in the EPRI report, the staff finds the applicant's identification of cracking due to SCC in copper components exposed to treated water to be acceptable.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the One-Time Inspection Program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of cracking due to SCC for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of cracking due to SCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC in valve bodies and flow devices made of copper alloy with 15% or greater zinc exposed to an environment of treated water in the emergency feedwater system acceptable.

The staff noted that for nickel alloy piping and fittings, exposed to an air with borated water leakage (external) environment, the applicant assigned no aging effect and therefore no aging management program was assigned for these component/material/environment combinations. The staff noted that austenitic materials such as nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," Volumes 1 and 2, April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

In LRA Table 3.4.2-3, the applicant designated Note G for aluminum alloy sight glass housings and Note H for copper alloy (Zn less than 15%) piping fittings and copper alloy (Zn greater than 15%) sight glass housings exposed to a lubricating oil environment in the emergency feedwater system because the loss of material due to microbiologically-influenced corrosion for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for the copper piping, fittings and sight glass housings and the environment is not in the GALL Report for the aluminum alloy sight glass Housings. The staff reviewed the GALL Report and found that the AMR line item, copper alloy piping, fittings, and sight glass housings is not evaluated for a lubricating oil environment for loss of material due to microbiologically-influenced corrosion and that the GALL Report does not address aluminum sight glass housings exposed to lubricating oil. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, and MIC. The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. On this basis, the staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these aluminum and copper alloy components exposed to lubricating oil through the period of extended operation.

In LRA Table 3.4.2-3, the applicant stated that for steel piping and fittings, and valve bodies in treated water environment in the emergency feedwater system, wall thinning due to flow-accelerated corrosion is not an aging effect requiring management. The applicant referenced footnote "I, 2" stating that this system is a single phase system with a temperature below 200 ^{o}F and additionally, the system operates less than 2% of plant operating time.

The staff reviewed EPRI guidelines in NSAC-202L-R2 that are referenced in the GALL AMP XI.M17, "Flow-Accelerated Corrosion." This document provides guidelines for maintaining integrity of steel piping and valves containing high-energy fluids. The document considers temperature and operating time as criteria for susceptibility review and the temperature below 200 ^{o}F, and operation less than 2% of plant operating time is under the limits for non-susceptibility for single-phase systems. On the basis that the emergency feedwater system is in normal stand-by and operates for less than 2% of the plant operating time, and the temperature is less than 200 ^{o}F, the staff finds that this system is not a high-energy fluid system, and therefore, wall thinning due to flow-accelerated corrosion is not an aging effect requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.4 Steam and Power Conversion System – Extraction Steam System – Summary of Aging Management Evaluation – LRA Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarizes the results of AMRs for the extraction steam system component groups.

In LRA Table 3.4.2-4, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) for piping and fittings and valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water (internal) using the Water Chemistry Program and the One-Time Inspection Program. For these components, the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for copper alloy with 15% or greater zinc in a treated water environment include cracking due to SCC.

The staff confirmed that the GALL Report does not list cracking due to SCC as an aging effect applicable for copper alloy with 15% or greater zinc exposed to treated water. The staff also reviewed selected portions of EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006. The staff noted that Section 3.2.2, Appendix A of the EPRI report states that in the presence of ammonia or other ammonium compounds that may be in used in treated water systems, cracking due to SCC can occur in copper alloys containing 15% or greater zinc. On the basis that the aging effect is identified in the EPRI report, the staff finds the applicant's identification of cracking due to SCC in copper components exposed to treated water to be acceptable.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of cracking due to SCC for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of cracking due to SCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC in piping and fittings and valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water in the extraction steam system to be acceptable.

In LRA Table 3.4.2-4, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) for valve bodies and flow devices made of copper alloy with 15% or greater zinc exposed to an environment of treated water (internal) using the Water Chemistry Program and the One-Time Inspection Program. For these components the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for copper alloy with 15% or greater zinc in a treated water environment include cracking due to SCC.

The staff confirmed that the GALL Report does not list cracking due to SCC as an aging effect applicable for copper alloy with 15% or greater zinc exposed to treated water. The staff also reviewed selected portions of EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006. The staff noted that

Section 3.2.2, Appendix A of the EPRI report states that in the presence of ammonia or other ammonium compounds that may be in used in treated water systems, cracking due to SCC can occur in copper alloys containing 15% or greater zinc. On the basis that the aging effect is identified in the EPRI report, the staff finds the applicant's identification of cracking due to SCC in copper components exposed to treated water to be acceptable.

In LRA Table 3.4.2-4, the applicant stated that for glass sight glasses in air–gas wetted internal environment there are no aging effects requiring management. The applicant referenced footnote "G" for this line item indicating that environment is not listed in the GALL Report for this material and component combination.

As indicated in "Corrosion Handbook" by H.H.Uhlig, the staff noted that glass as a material is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since air-gas wetted internal environment does not contain hydroflouric acid or caustics. Based on this review and on the industry operating experience, the staff finds that glass in an air-gas wetted internal environment will not have any aging effects requiring aging management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.5 Steam and Power Conversion System – Feedwater System – Summary of Aging Management Evaluation – LRA Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarizes the results of AMRs for the feedwater system component groups.

In LRA Table 3.4.2-5, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) for valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water (internal) using the Water Chemistry Program and the One-Time Inspection Program. For these components the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for copper alloy with 15% or greater zinc in a treated water environment include cracking due to SCC.

The staff confirmed that the GALL Report does not list cracking due to SCC as an aging effect applicable for copper alloy with 15% or greater zinc exposed to treated water. The staff also reviewed selected portions of EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006. The staff noted that Section 3.2.2, Appendix A of the EPRI report states that in the presence of ammonia or other ammonium compounds that may be in used in treated water systems, cracking due to SCC can occur in copper alloys containing 15% or greater zinc. On the basis that the aging effect is identified in the EPRI report, the staff finds the applicant's identification of cracking due to SCC in copper components exposed to treated water acceptable.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the program is consistent with GALL AMP XI.M32, "One-Time Inspection," and is adequate to detect the presence or note the absence of cracking due to SCC for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of cracking due to SCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC in valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water in the feedwater system to be acceptable.
The staff noted that for nickel alloy piping, fittings, thermowells, exposed to an air with borated water leakage (external) environment, the applicant assigned no aging effect and therefore no aging management program was assigned for these component/material/environment combinations.

The staff noted that austenitic materials such nickel alloys are not subject to loss of material or cracking when subjected to this environment and these materials are used as corrosion resistant replacement materials where other materials have degraded. According to EPRI 5769, "Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2," April 1988, corrosion resistant materials such as austenitic and martensitic stainless steels and high strength nickel base alloys offer good protection against boric acid corrosion. Therefore no aging management program is necessary for nickel alloys in the air with borated water leakage (external) environment.

The applicant designated Note H for copper alloy (Zn less than 15%) piping fittings exposed to a lubricating oil environment in the feedwater system because the loss of material due to microbiologically-influenced corrosion for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for the copper piping and fittings. The staff reviewed the GALL Report and concluded that the AMR line item, copper alloy piping and fittings, is not evaluated for a lubricating oil environment for loss of material due to microbiologically-influenced corrosion . The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, and MIC. The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. The staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these copper alloy components exposed to lubricating oil through the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.6 Steam and Power Conversion System – Main Generator and Auxiliary Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-6

The staff reviewed LRA Table 3.4.2-6, which summarizes the results of AMR evaluations for the main generator and auxiliary systems component groups.

In LRA Table 3.4.2-6, the applicant designated Note H for copper alloy (Zn less than 15%) piping, fittings and valves exposed to a lubricating oil environment in the main generator and auxiliary system because the loss of material due to microbiologically-influenced corrosion for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for the copper piping, and fittings. The staff reviewed the GALL Report and concluded that the AMR line item, copper alloy piping, fittings, and valves is not evaluated for a lubricating oil environment for loss of material due to microbiologically-influenced corrosion. The applicant credits the Lubricating Oil Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, microbiologically influence corrosion. The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion in susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. The staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these copper alloy components exposed to lubricating oil through the period of extended operation.

In LRA Table 3.4.2-6, the applicant stated that for glass tank and sight glasses in air-gas wetted internal environment there are no aging effects requiring management. The applicant referenced footnote "G" for this line item indicating that environment is not listed in the GALL Report for this material and component combination.

As indicated in "Corrosion Handbook" by H.H.Uhlig, the staff noted that glass as a material is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since air-gas wetted internal environment does not contain hydroflouric acid or caustics. Based on this review and on the industry operating experience, the staff finds that glass in an air-gas wetted internal environment will not have any aging effects requiring aging management.

In LRA Table 3.4.2-6, the applicant stated that for polytetrafluoroethylene (PTFE) piping and fittings in treated water and air-indoor environments, there are no aging effects requiring management. The applicant referenced footnote “F” for this line item indicating that material is not listed in the GALL Report for this component and environment combination.

As identified in “Engineering Materials Handbook – Engineering Plastics,” the staff noted that PTFE is a thermoplastic member of the fluoropolymer family of plastics and has a low coefficient of friction, excellent insulating properties, and is chemically inert to most substances. The staff also noted that unlike metals, thermoplastics do not display corrosion rates, and rather than depend on an oxide layer for protection, they depend on chemical resistance to the environments to which they are exposed. The use of thermoplastics in power plant environments is a design-driven criterion. The staff acknowledges that PTFE is an impervious material and once selected for the environment will not have any significant age related degradation. The staff has not observed any age related industry experience for PTFE material in treated water and air-indoor environments. Based on this review, the staff finds that for PTFE piping and fittings in treated water and air-indoor environments there are no aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of combinations of material, environment, AERM, and AMP not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.7 Steam and Power Conversion System – Main Steam System – Summary of Aging Management Evaluation – LRA Table 3.4.2-7

The staff reviewed LRA Table 3.4.2-7, which summarizes the results of AMRs for the main steam system component groups.

In LRA Table 3.4.2-7, the applicant proposed to manage cracking due to stress corrosion cracking (SCC) for piping and fittings and valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water (internal) using the Water Chemistry Program and the One-Time Inspection Program. For these components the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for copper alloy with 15% or greater zinc in a treated water environment include cracking due to SCC.

The staff confirmed that the GALL Report does not list cracking due to SCC as an aging effect applicable for copper alloy with 15% or greater zinc exposed to treated water. The staff also reviewed selected portions of EPRI Report 1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006. The staff noted that Section 3.2.2, Appendix A of the EPRI report states that in the presence of ammonia or other ammonium compounds that may be used in treated water systems, cracking due to SCC can occur in copper alloys containing 15% or greater zinc. On the basis that the aging effect is identified in the EPRI report, the staff finds the applicant’s identification of cracking due to SCC in copper components exposed to treated water acceptable.

The staff reviewed the applicant’s Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that Water Chemistry Program, with an enhancement, is consistent with GALL AMP XI.M2, “Water Chemistry.” The staff reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.2.14. The staff finds that the One-Time Inspection Program is consistent with GALL AMP XI.M32, “One-Time

Inspection," and is adequate to detect the presence or note the absence of cracking due to SCC for components within the scope of the program. Based on the staff's determination that the Water Chemistry Program provides mitigation and the One-Time Inspection Program provides detection for the potential aging effect of cracking due to SCC, the staff finds the applicant's proposed AMPs for managing the aging effect of cracking due to SCC in piping and fittings and valve bodies made of copper alloy with 15% or greater zinc exposed to an environment of treated water in the main steam system acceptable.

In LRA Table 3.4.2-7, the applicant proposed to manage loss of material due to general corrosion for carbon steel and low alloy steel piping and fittings and for carbon steel valve bodies exposed to an environment of steam (internal) using the Water Chemistry Program. For these components the applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also cited a plant-specific note stating that the aging effects/mechanisms for carbon steel and low alloy steel in a steam environment include loss of material due to general corrosion.

The staff noted that in the GALL Report, Volume 1, Table 4, Item 37 provides aging management results for steel, stainless steel and nickel-based alloy piping, piping components, and piping elements exposed to steam in the main steam system. The staff also noted that this AMR result line identifies the aging effect as loss of material due to pitting and crevice corrosion and recommends use of the Water Chemistry Program to manage the aging effect. Because the GALL Report line item for these main steam piping components does not explicitly list general corrosion as an aging mechanism that may cause loss of material in carbon steel piping and piping components exposed to a steam environment, the staff finds the applicant's identification of loss of material due to general corrosion for carbon steel valve bodies exposed to a steam environment acceptable.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds that the program, with an enhancement, is consistent with GALL AMP XI.M2, "Water Chemistry." The staff noted that in the SRP-LR, Table 3.4-1, Item 37, the AMP recommended for managing the aging effect of loss of material due to pitting and crevice corrosion for steel piping and fittings in a steam environment is the Water Chemistry Program, alone. The staff also noted that the applicant proposed to manage the same aging effect due to a different mechanism (general corrosion) using the same program as recommended in SRP-LR, Table 3.4-1, item 37. Based on the staff's determination that the applicant's Water Chemistry Program is consistent with the GALL Report AMP and on the SRP-LR's recommendation of the Water Chemistry Program, alone, for managing the aging effect of corrosion in a steam environment, the staff finds the applicant's proposed AMP for managing the aging effect of loss of material due to general corrosion in carbon steel and low alloy steel piping and fittings and carbon steel valve bodies exposed to an environment of steam in the main steam system to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

3.4.2.3.8 Steam and Power Conversion System – Steam Turbine and Auxiliary Systems – Summary of Aging Management Evaluation – LRA Table 3.4.2-8

The staff reviewed LRA Table 3.4.2-8, which summarizes the results of AMRs for the steam turbine and auxiliary systems component groups.

In LRA Table 3.4.2-8, the applicant proposed to manage loss of material due to erosion for carbon steel material for piping and fittings exposed to an external treated water environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material and environment combination.

Based on the staff's review of this AMR item, the staff determined that additional information was needed regarding the applicant's proposed AMP for this AMR item. In RAI 3.4.2-8-1, dated October 15, 2008 the staff requested that the applicant provide additional information clarifying how the inspection of the internal surface of piping and fittings will be representative of the aging and degradation that would be occurring from the external treated water environment.

In its response to the RAI dated November 12, 2008, the applicant stated that the configuration of the carbon steel piping and fitting that this AMR line item references. Based on the applicant's clarification, the staff noted that the piping and fittings are internal to the main condenser steam space, but are subject to loss of material due to erosion on the external surface of the piping and fittings.

Based on its review, the staff finds the applicant's response to RAI 3.4.2-8-1 acceptable because the applicant clarified that Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was chosen because these components are internal to the main condenser steam space, but the external surface of these components is subject to erosion and exposed to this environment. The staff's concern described in RAI 3.4.2-8-1 is resolved.

The staff reviewed the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.2.17. The staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspections of internal surfaces during periodic system and component surveillance activities or during maintenance activities when the internal surface is accessible for visual inspections to detect aging effects that could result in a loss of the component's intended function. On the basis of its review, the staff finds that because these components will be inspected periodically by visual inspections when exposed to an internal environment of treated water they will be adequately managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-8, the applicant designated Note G for Aluminum Alloy Valve Bodies and Note H for copper alloy piping, fittings, filter housings, heat exchanger components, pump casings, and valve bodies exposed to a lubricating oil environment in the steam turbine and auxiliaries system because the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report for the copper alloy components and the environment is not in the GALL Report for the aluminum alloy components. The staff reviewed the GALL Report and found that the AMR line item, piping and fittings is not evaluated for a lubricating oil environment for loss of material due to pitting, crevice, microbiologically influence corrosion and that the GALL Report does not address aluminum filter housings exposed to lubricating oil and accordingly Note G is appropriate. The applicant credits the Lubricating Oil

Analysis Program and the One-time Inspection Program for managing loss of material due to pitting, crevice, microbiologically-influenced corrosion. The staff reviewed the Lubricating Oil Analysis Program and the One-Time Inspection program and its evaluations are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.14, respectively. The staff finds that these programs 1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting, crevice and microbiologically-influenced corrosion and 2) will provide for one-time inspections of select components exposed to lubricating oil for loss of material due to pitting, crevice and microbiologically-influenced corrosion at susceptible locations to verify the effectiveness of the Lubricating Oil Analysis Program. The staff noted that one-time inspection is an acceptable method to determine whether or not loss of material is occurring slowly such that the intended function will be maintained during the period of extended operation. The staff finds that the Lubricating Oil Analysis Program and the One-Time Inspection Program are adequate to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion for these aluminum and copper alloy components exposed to lubricating oil through the period of extended operation.

In LRA Table 3.4.2-8, the applicant stated that for glass sight glasses in air–gas wetted internal environment there are no aging effects requiring management. The applicant referenced footnote "G" for this line item indicating that environment is not listed in the GALL Report for this material and component combination.

As indicated in "Corrosion Handbook" by H.H.Uhlig, the staff noted that that glass as a material is impervious to normal plant environments. This conclusion is based on industry experience where the staff noted that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at temperatures or during time periods of concern for extended operation. The staff acknowledges that the use of glass in power plant environments is a design-driven criterion and once selected for the environment will not have any significant age related degradation, since air-gas wetted internal environment does not contain hydroflouric acid or caustics. Based on this review and on the industry operating experience, the staff finds that glass in an air-gas wetted internal environment will not have any aging effects requiring aging management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended 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 Containments, Structures, and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the containments, structures, and component supports of the following:

- Air Intake Structures
- Auxiliary Building
- Circulating Water Pump House
- Control Building
- Diesel Generator Building
- Dike/Flood Control System
- Fuel Handling Building
- Intake Screen and Pump House
- Intermediate Building
- Mechanical Draft Cooling Tower Structures
- Miscellaneous Yard Structures
- Natural Draft Cooling Tower
- Structural Commodities
- Reactor Building (containment)
- SBO Diesel Generator Building
- Service Building
- Component Supports Commodity Group
- Substation Structures
- Turbine Building
- UPS Diesel Building

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for structures, structural components, and component supports. LRA Table 3.5.1, "Summary of Aging Management Evaluations for Structures and Component Supports," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging for the containment, structures and component supports 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 AMRs to confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The following programs are credited for managing the aging effects for the structures and component supports:

- Structures Monitoring Program
- Boric Acid Corrosion
- Selective leaching of Material
- Buried Piping and Tank Inspection
- One-Time Inspection
- Water Chemistry
- 10 CFR Part 50, Appendix J
- ASME Section XI, Subsection – IWE
- ASME Section XI, Subsection – IWF
- ASME Section XI, Subsection – IWL
- External Surfaces Monitoring
- TLAA

The staff reviewed the AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Section 3.5.2.1 and 3.5.2.2.

The staff also reviewed the AMRs not consistent with or not addressed in the GALL Report. The review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Details of the staff's evaluation are discussed in SER Section 3.5.2.3.

For components which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.5-1 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 Containments, Structures, and Component Supports in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable). (3.5.1-1)	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater if environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes	ISI (IWL) for containment concrete Structures Monitoring Program for groundwater monitoring Boric Acid Corrosion	Consistent with GALL Report (See SER Sections 3.5.2.1.2 and 3.5.2.2.1)
Concrete elements; All (3.5.1-2)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not applicable	See SER Section 3.5.2.2.1
Concrete elements: foundation, sub-foundation (3.5.1-3)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon to control erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not applicable	See SER Section 3.5.2.2.1
Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable) (3.5.1-4)	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	See SER Section 3.5.2.2.1

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements: drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppression chamber (as applicable) (3.5.1-5)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Steel elements: steel liner, liner anchors, integral attachments (3.5.1-6)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes	ISI (IWE) and 10 CFR Part 50, Appendix J	Consistent with GALL Report, (See SER Section 3.5.2.2.1)
Prestressed containment tendons (3.5.1-7)	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Steel and stainless steel elements: vent line, vent header, vent line bellows; downcomers; (3.5.1-8)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-9)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA - Metal fatigue	Consistent with GALL Report (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds (3.5.1-10)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations/ evaluations for bellows assemblies and dissimilar metal welds.	Yes	Not applicable	See SER Section 3.5.2.2.1
Stainless steel vent line bellows, (3.5.1-11)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination/ evaluation for bellows assemblies and dissimilar metal welds.	Yes	Not applicable	Not applicable to BWRs (See SER Section 3.5.2.1.1)
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-12)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes	ISI (IWE) and 10 CFR Part 50, Appendix J	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers (3.5.1-13)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Concrete elements: dome, wall, basemat ring girder, buttresses, containment (as applicable) (3.5.1-14)	Loss of material (scaling, cracking, and spalling) due to freeze-thaw	ISI (IWL). Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	ISI (IWL).	Consistent with GALL Report (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable). (3.5.1-15)	Cracking due to expansion and reaction with aggregate; increase in porosity, permeability due to leaching of calcium hydroxide	ISI (IWL) for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R.	Yes	ISI (IWL)	Consistent with GALL Report, (See SER Section 3.5.2.2.1)
Seals, gaskets, and moisture barriers (3.5.1-16)	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ISI (IWE) and 10 CFR Part 50, Appendix J	Consistent with GALL Report, (See SER Section 3.5.2.1)
Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms (3.5.1-17)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and plant Technical Specifications	No	App. J and Plant Technical Specification program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch and CRD hatch (3.5.1-18)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	IWE, and App. J	Consistent with GALL Report, (See SER Section 3.5.2.1)
Steel elements: stainless steel suppression chamber shell (inner surface) (3.5.1-19)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable to BWRs (See SER Section 3.5.2.1.1)
Steel elements: suppression chamber liner (interior surface) (3.5.1-20)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable to BWRs (See SER Section 3.5.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements: drywell head and downcomer pipes (3.5.1-21)	Fretting or lock up due to mechanical wear	ISI (IWE)	No	Not applicable	Not applicable to BWRs (See SER Section 3.5.2.1.1)
Prestressed containment: tendons and anchorage components (3.5.1-22)	Loss of material due to corrosion	ISI (IWL)	No	ISI (IWL)	Consistent with GALL Report, (See SER Section 3.5.2.1)
All Groups except Group 6: interior and above grade exterior concrete (3.5.1-23)	Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes	Structures Monitoring Program Boric Acid Corrosion	Consistent with GALL Report (See SER Section 3.5.2.1.3)
All Groups except Group 6: interior and above grade exterior concrete (3.5.1-24)	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Structures Monitoring Program	Yes	Structures Monitoring Program Boric Acid Corrosion	Consistent with GALL Report (See SER Section 3.5.2.1.4)
All Groups except Group 6: steel components: all structural steel (3.5.1-25)	Loss of material due to corrosion	Structures Monitoring Program. If protective coatings are relied upon to manage the effects of aging, the Structures Monitoring Program is to include provisions to address protective coating monitoring and maintenance.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
All Groups except Group 6: accessible and inaccessible concrete: foundation (3.5.1-26)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Structures Monitoring Program. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
All Groups except Group 6: accessible and inaccessible interior/exterior concrete (3.5.1-27)	Cracking due to expansion due to reaction with aggregates	Structures Monitoring Program. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.2)
Groups 1-3, 5-9: All (3.5.1-28)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.2)
Groups 1-3, 5-9: foundation (3.5.1-29)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not applicable	Not Applicable to TMI-1 (See SER Section 3.5.2.2.2)
Group 4: radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; steam generator supports (3.5.1-30)	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes	ISI (IWF) or Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 1-3, 5, 7-9: below-grade concrete components, such as exterior walls below grade and foundation (3.5.1-31)	Increase in porosity and permeability, cracking, loss of material (spalling, scaling), aggressive chemical attack; cracking, loss of bond, and loss of material (spalling, scaling), corrosion of embedded steel	Structures Monitoring Program; examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.2)
Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations (3.5.1-32)	Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide	Structures Monitoring Program for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.2)
Groups 1-5: concrete (3.5.1-33)	Reduction of strength and modulus due to elevated temperature	A plant-specific aging management program is to be evaluated	Yes	Not applicable	See SER Section 3.5.2.2.2
Group 6: concrete; all (3.5.1-34)	Increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; cracking, loss of bond, loss of material due to corrosion of embedded steel	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: exterior above and below grade concrete foundation (3.5.1-35)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Structure Monitor Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
Group 6: all accessible and inaccessible reinforced concrete (3.5.1-36)	Cracking due to expansion / reaction with aggregates	Accessible areas: Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
Group 6: exterior above and below grade reinforced concrete foundation interior slab (3.5.1-37)	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.2.)
Groups 7, 8: tank liners (3.5.1-38)	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes	Not applicable	Not Applicable to TMI-1 (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-39)	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates (3.5.1-40)	Reduction in concrete anchor capacity due to local concrete degradation, service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Vibration isolation elements (3.5.1-41)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds (3.5.1-42)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to TMI-1 (See SER Section 3.5.2.2. 2)
Groups 1-3, 5, 6: all masonry block walls (3.5.1-43)	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.1.5)
Group 6: elastomer seals, gaskets, and moisture barriers (3.5.1-44)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Group 6: exterior above and below grade concrete foundation; interior slab (3.5.1-45)	Loss of material due to abrasion, cavitation	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	No	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 5: fuel pool liners (3.5.1-46)	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Water Chemistry and monitoring of spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No	Water Chemistry Control Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Group 6: all metal structural members (3.5.1-47)	Loss of material due to general (steel only), pitting and crevice corrosion	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	Structures Monitoring Program	Consistent with GALL Report (See SER Sections 3.3.2.1.3, 3.2.2.1.4)
Group 6: earthen water control structures - dams, embankments, reservoirs, channels, canals, and ponds (3.5.1-48)	Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, Seepage	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs	No	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-49)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	No	Water Chemistry and IWF Program	Consistent with GALL Report, (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups B2, and B4: galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-50)	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Aboveground Steel Tanks External Surfaces Monitoring Program Structures Monitoring Program	Consistent with GALL Report (See SER Sections 3.5.2.1.6 and 3.4.2.1.3, 3.3.2.1.3, 3.2.2.1.4)
Group B1.1: high strength low-alloy bolts (3.5.1-51)	Cracking due to stress corrosion cracking; loss of material due to general corrosion	Bolting Integrity	No	Not Applicable	Not Applicable to TMI-1 (See SER Section 3.5.2.1.1)
Groups B2, and B4: sliding support bearings and sliding support surfaces (3.5.1-52)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure (3.5.1-53)	Loss of material due to general and pitting corrosion	ISI (IWF)	No	IWF Program	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: constant and variable load spring hangers; guides; stops; (3.5.1-54)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	ISI (IWF)	Consistent with GALL Report, (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, galvanized steel, and aluminum support members; welds; bolted connections; support anchorage to building structure (3.5.1-55)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: sliding surfaces (3.5.1-56)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	ISI (IWF)	Consistent with GALL Report, (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: vibration isolation elements (3.5.1-57)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, sustained vibratory loading	ISI (IWF)	No	Not applicable	Not applicable to TMI-1 (See SER Section 3.5.2.1.1)
Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air - indoor uncontrolled (3.5.1-58)	None	None	No	None	Consistent with GALL Report, (See SER Section 3.5.2.1)
Stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-59)	None	None	No	None	Consistent with GALL Report, (See SER Section 3.5.2.1)

The staff's review of the containments, structures, and component support groups followed several approaches. One approach, documented in SER Section 3.5.2.1, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.5.2.2, discusses the staff's review of AMR results for components the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, discusses the staff's review of AMR results for components the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the containments, structures, and component supports is documented in SER Section 3.0.3.

3.5.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.5.2.1, identifies the materials, environments, and AERMs. The applicant identified the following programs that manage the effects of aging related to structures and component supports:

- Structures Monitoring Program
- Boric Acid Corrosion
- Selective Leaching of Material
- Buried Piping and Tank Inspection
- One-Time Inspection
- Water Chemistry
- 10 CFR Part 50, Appendix J
- ASME Section XI, Subsection – IWE
- ASME Section XI, Subsection – IWF
- ASME Section XI, Subsection – IWL
- External Surfaces Monitoring
- Water Chemistry
- TLAA

In LRA Tables 3.5.2-1 through 3.5.2-20, the applicant summarized AMRs for structures and component supports and indicated AMRs claimed to be consistent with the GALL Report. For component groups evaluated in the LRA for which the applicant claimed consistency with the GALL Report and for which the GALL Report does not recommend further evaluation, the staff's review determined whether the plant-specific components groups were bounded by the GALL Report evaluation.

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

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

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

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the staff verified that 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 a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

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

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

The staff reviewed the information in the LRA, as documented in the SER Section 3.5.2.1. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.5.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.5.1 Items 5, 8, 11, 13, 19, 20, and 21 are identified as "Not Applicable" because they apply only to BWR containments. The staff confirmed that the applicant identified the correct items as being not applicable for this reason.

LRA Table 3.5.1, Items 51 and 57 are identified as "Not Applicable" since the component, material, and environment combination does not exist at TMI-1. For each of these line items, the staff reviewed the LRA and the applicant's supporting documents, and confirmed the applicant's claim that the component, material, and environment combination does not exist at TMI-1. Since TMI-1 does not have the component, material, and environment combination for these Table 1 line items, the staff finds that these AMRs are not applicable to TMI-1.

3.5.2.1.2 Aging of Accessible and Inaccessible Concrete Areas Due to Aggressive Chemical Attack, and Corrosion of Embedded Steel

LRA Table 3.5.1, Item 3.5.1-1 states that the ASME Section XI, Subsection IWL Program will be used to manage aging effects due to aggressive chemical attack, and corrosion of embedded steel of reactor building (containment) reinforced concrete in accessible areas. The LRA also states that the Boric Acid Corrosion Program will also be used to manage the aging effect/mechanism in areas subject to borated water leakage. During the review of LRA Tables

3.5.2-1 through 3.5.2-20, the staff noted that for the AMR results line that points to item 3.5.1-1 in LRA Table 3.5.1, the applicant included fourteen groups that reference Note E and plant-specific Note 1 or Note 5 (depending on the table), which both state “The aging effects/mechanisms of reinforced concrete in an air with borated water leakage environment include cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Boric Acid Corrosion Program.”

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 1 and Note 5, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S2, “ASME Section XI, Subsection IWL,” the applicant has additionally proposed using the Boric Acid Corrosion Program. The GALL Report line item referenced is for concrete elements: walls, basemat, buttresses, containment, etc., and therefore, the GALL Report recommends AMP XI.S2. The applicant stated that the AMR result line items that reference item 3.5.1-1 in LRA Table 3.5.1, are also located in the areas subject to borated water leakage, and, therefore, the Boric Acid Corrosion Program was also credited. The staff reviewed the Boric Acid Corrosion Program and ASME Section XI, Subsection IWL Program and found that both require visual inspections on a periodic basis to manage aggressive chemical attack due to borated water leakage. On the basis that periodic visual inspections are performed, the staff finds the applicant's additional use of the Boric Acid Corrosion Program to be acceptable.

Based on a review of the programs identified above, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.3 Cracking, Loss of Bond, and Loss of Material (spalling, scaling) Due to Corrosion of Embedded Steel

In the discussion section of LRA Table 3.5.1, Item 3.5.1-23, the applicant stated that cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel is managed by the Structures Monitoring Program. The Boric Acid Corrosion Program will also be used to manage the aging effect/mechanism in areas subject to borated water leakage. During the review of LRA Tables 3.5.2-1 through 3.5.2-20, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-23, for twenty-six groups the applicant included a reference to Note E and plant-specific Note 1, which states “the aging effects/mechanisms of reinforced concrete in an air with borated water leakage environment include cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Boric Acid Corrosion Program.”

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 1, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S6, “Structures Monitoring Program,” the applicant has additionally proposed using the Boric Acid Corrosion Program. The GALL Report line item referenced is reinforced concrete, and therefore, the GALL Report recommends AMP XI.S6. The applicant stated that the AMR result line items that reference LRA Table 3.5.1 item 3.5.1-23 are also located in the areas subject to borated water leakage, and, therefore, the Boric Acid Corrosion Program was also credited. The staff reviewed the Boric Acid Corrosion Program and Structures Monitoring

Program and found that both require visual inspections on a periodic basis to manage aggressive chemical attack due to borated water leakage. On the basis that periodic visual inspections are performed, the staff finds the applicant's additional use of the Boric Acid Corrosion Program to be acceptable.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.4 Increase in Porosity and Permeability, Cracking, Loss of Material (spalling, scaling) Due to Aggressive Chemical Attack

In the discussion section of LRA Table 3.5.1, item 3.5.1-24, the applicant stated that increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack is managed by the Structures Monitoring Program. The Boric Acid Corrosion Program will also be used to manage the aging effect/mechanism in areas subject to borated water leakage. During the review of LRA Tables 3.5.2-1 through 3.5.2-20, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-24, for twenty-six groups the applicant included a reference to Note E and plant-specific Note 5 or 6 (depending on the table), which states "the aging effects/mechanisms of reinforced concrete in an air with borated water leakage environment include cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Boric Acid Corrosion Program."

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 5 and 6, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S6, "Structures Monitoring Program," the applicant has additionally proposed using the Boric Acid Corrosion Program. The GALL Report line item referenced is reinforced concrete, and therefore, the GALL Report recommends AMP XI.S6. The applicant stated that the AMR result line items that reference LRA table 3.5.1 item 3.5.1-24 are also located in the areas subject to borated water leakage, and, therefore, the Boric Acid Corrosion Program was also credited. The staff reviewed the Boric Acid Corrosion Program and Structures Monitoring Program and found that both require visual inspections on a periodic basis to manage aggressive chemical attack due to borated water leakage. On the basis that periodic visual inspections are performed, the staff finds the applicant's additional use of the Boric Acid Corrosion Program to be acceptable.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.5 Cracking Due to Restraint Shrinkage, Creep, and Aggressive Environment for Masonry Block Walls

In the discussion section of LRA Table 3.5.1, item 3.5.1-43, the applicant stated that cracking due to restraint shrinkage, creep, and aggressive environment is managed by Structures Monitoring Program. The Boric Acid Corrosion Program will also be used to manage the aging effect/mechanism in areas subject to borated water leakage. During the review of LRA Tables 3.5.2-1 through 3.5.2-20, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-43, for one group the applicant included a reference to Note E and plant-specific Note 6, which states "the aging effects/mechanisms of reinforced concrete in an air with borated water leakage environment include cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Boric Acid Corrosion Program."

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 6, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S6, "Structures Monitoring Program," the applicant has additionally proposed using the Boric Acid Corrosion Program. The GALL Report line item referenced is reinforced concrete, and therefore, the GALL Report recommends AMP XI.S6. The applicant stated that the AMR result line item that references LRA Table 3.5.1 item 3.5.1-43 is also located in the areas subject to borated water leakage, and, therefore, the Boric Acid Corrosion Program was also credited. The staff reviewed the Boric Acid Corrosion Program and Structures Monitoring Program and found that both are performing visual inspections on a periodic basis to manage aggressive chemical attack due to borated water leakage. On the basis that periodic visual inspections are performed, the staff finds the applicant's additional use of the Boric Acid Corrosion Program to be acceptable.

Based on a review of the programs identified above, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.6 Loss of Material Due to Pitting and Crevice Corrosion

In the discussion section of LRA Table 3.5.1, item 3.5.1-50, the applicant stated that loss of material due to pitting and crevice corrosion is managed by Structures Monitoring Program. The External Surfaces Monitoring Program will also be used to monitor loss of material due to pitting and crevice corrosion of piping and component insulation jacketing. During the review of LRA Tables 3.5.2-1 through 3.5.2-20, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-50, for two groups the applicant included a reference to Note E and plant-specific Note 4 or Note 5 which both state, "the aging effects of aluminum (Note 4) or stainless steel (Note 5) in this environment include loss of material due to pitting and crevice corrosion. These aging effects/mechanisms are managed by the External Surfaces Monitoring Program."

The staff reviewed the AMR results lines referenced to Note E, plant-specific Note 4 and Note 5, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends

AMP XI.S6, “Structures Monitoring Program,” the applicant has proposed using the External Surfaces Monitoring Program to monitor loss of material due to pitting and crevice corrosion of piping and component insulation jacketing. The staff reviewed the Structures Monitoring Program and External Surfaces Monitoring Program, and found that both of the programs are performing visual inspections on a periodic basis to manage loss of material due to pitting and crevice corrosion. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the External Surfaces Monitoring Program to be acceptable.

Based on a review of the programs identified, the staff determines that the applicant’s proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results That Are 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 containments, structures, and component supports, and provides information concerning how it will manage aging effects in the following three areas:

(1) PWR and BWR containments:

- aging of inaccessible concrete areas
- cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations if not covered by the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to general, pitting, and crevice corrosion
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to SCC
- cracking due to cyclic loading
- loss of material (scaling, cracking, and spalling) due to freeze-thaw
- cracking due to expansion and reaction with aggregate and increase in porosity and permeability due to leaching of calcium hydroxide

(2) Safety-related and other structures and component supports:

- aging of structures not covered by the Structures Monitoring Program
- aging management of inaccessible areas
- reduction of strength and modulus of concrete structures due to elevated temperature
- aging management of inaccessible areas for Group 6 structures
- cracking due to SCC and loss of material due to pitting and crevice corrosion
- aging of supports not covered by the Structures Monitoring Program
- cumulative fatigue damage due to cyclic loading

(3) QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report for which the applicant had claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluations to determine whether they adequately address those issues and reviewed the applicant's further evaluations against the criteria in SRP-LR Section 3.5.2.2. Details of the staff's audit are documented in the Audit and Review Report. The staff's evaluation of the aging effects is discussed in the following sections.

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.

<u>Aging of Inaccessible Concrete Areas</u>. The staff reviewed LRA Section 3.5.2.2.1.1 using the review procedures of SRP-LR Section 3.5.2.2.1.1.

LRA Section 3.5.2.2.1.1 states that the ASME Section XI, Subsection IWL Program is used to manage aging effects due to aggressive chemical attack, and corrosion of embedded steel of reactor building (containment) reinforced concrete. In addition, the applicant stated that the Boric Acid Corrosion Program is also used to manage the aging effect/mechanism in areas subject to borated water leakage. The applicant further stated that historical chemistry results of groundwater water samples have confirmed that groundwater remains non-aggressive to concrete. Groundwater water is periodically monitored as required by the Structures Monitoring Program, and a representative sample of below-grade concrete will be inspected if excavated for any reason.

SRP-LR Section 3.5.3.2.1.1 states that increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in inaccessible areas of concrete and steel containments. SRP-LR Section 3.5.2.2.1.1 further states that the existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The TMI-1 ASME Section XI, Subsection IWL described in LRA Section B.2.1.25 is an existing program that is consistent with all elements of GALL AMP X1.S2 “ASME Section XI, Subsection IWL.” The staff’s review of the applicant’s ASME Section XI, Subsection IWL is documented in SER Section 3.0.3.1.6.

SRP-LR Section 3.5.2.2.1.1 also states that the GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if the environment is aggressive. To ensure non-aggressive groundwater chemistries, the GALL Report suggests the periodic groundwater inspection for chlorides, sulfates, and pH. The staff noted that the groundwater monitoring is performed by the Structures Monitoring Program. The staff’s review of the applicant’s Structures Monitoring Program including periodic monitoring of groundwater is documented in SER Section 3.0.3.2.21.

The staff reviewed the LRA. The staff noted that the sampling results from 1996 presented in the LRA, which indicated a groundwater pH range of 6.1 - 6.7, a chloride range of 3.5 - 210 ppm, and a sulfate range of 14.1 - 410 ppm. During its Structures Monitoring Program AMP audit, the staff asked the applicant (RAI B.2.1.28-1, dated October 7, 2008) to provide the frequency of periodic sampling and the results for the last two samplings of groundwater. In the letter dated October 30, 2008, the applicant stated that the groundwater sampling for pH, chloride, and sulfate concentrations will be performed every 5 years during the period of extended operation. The applicant also demonstrated the last two groundwater samplings include one sample taken in 2007 and three taken in 2005, which showed a pH range of 7.4 – 7.8, a chloride range of 42.4 – 65.5 ppm, and a sulfate range of 27-53.3. Based on the above assertions, the staff confirmed that the below-grade environment at TMI-1 is non-aggressive (pH > 5.5, Chlorides < 500 ppm, and Sulfates <1500 ppm).

The staff noted that TMI-1 concrete is designed in accordance with American Concrete Institute (ACI) 318-63 and constructed in accordance with ACI 301-66. In the LRA, the applicant stated that containment concrete has a water-to-cement ratio of 0.44 with a 5000 psi compressive strength. The staff confirmed that the 0.44 water-to-cement ratio of TMI-1 containment concrete meets the recommendation of ACI 201.2R-77 for a water-to-cement ratio of less than 0.50 for a dense concrete with a low permeability.

On the basis of its review, the staff finds the AMR results to be consistent with the GALL Report. The staff agrees that a plant specific aging management program is not required for inaccessible areas of the reactor building (containment) below-grade concrete for the aging effects of increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel because (1) the groundwater water environment is confirmed not aggressive to concrete, (2) the inspection frequency of groundwater chemistries as required by the Structures Monitoring Program agrees with the recommendation of the GALL Report, and (3) the concrete being constructed meets the intent of ACI 201.2R for durability.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.1. For those line items that apply to LRA Section 3.5.2.2.1.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracks and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking and Differential Settlement due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.1.2 using the review procedures of SRP-LR Section 3.5.2.2.1.2.

LRA Section 3.5.2.2.1.2 states that the cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking and differential settlement due to erosion of porous concrete subfoundations are not aging effects requiring management because (1) the reactor building (containment) base foundation is founded on bedrock and no settlement has been experienced, (2) the containment base foundation is not constructed of porous concrete the, and (3) the containment does not employ a de-watering system for control of settlement.

SRP-LR Section 3.5.2.2.1.2 states that cracks and distortion due to increased stress levels from settlement could occur in concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in all types of containments. The existing program relies on the Structures Monitoring Program to manage these aging effects. SRP-LR Section 3.5.3.2.1.1 further states that the GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program. The staff reviewed the Structures Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.21.

On the basis of its review, the staff finds that cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking and differential settlement due to erosion of porous concrete subfoundations are not applicable aging effects because conditions necessary for the aging effects, such as soil environment and flowing water environment, as described in associated AMR line items of the GALL Report, Volume 2, do not exist. Therefore, the staff finds that no further evaluation is required.

Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.1.3 using the review procedures of SRP-LR Section 3.5.2.2.1.3

The applicant stated in LRA Section 3.5.2.2.1.3 that during normal plant operation, containment concrete general area temperatures do not exceed 150 °F and local area temperatures do not exceed 200 °F.

SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR concrete and steel containments. The GALL Report recommends further evaluation of a plant-specific aging management program if any portion of the concrete containment components exceeds specified temperature limits, i.e., general area temperature greater than 66 °C (150 °F) and local area temperature greater than 93 °C (200 °F).

The staff reviewed the LRA and noted that TMI-1 Technical Specification and UFSAR limit the bulk air temperature inside the building, which is maintained by re-circulating air through cooling coils, to 130 °F for areas above elevation 320' and 120 °F below this elevation during normal plant operation. Regarding local area temperatures, the staff also noted that process penetrations in the reactor building wall are provided with a cooling system to limit concrete temperature below 200 °F. On the basis of its review, the staff finds that reduction of strength and modulus of concrete due to elevated temperatures are not applicable aging effects because the conditions necessary for the aging effects, such as elevated temperatures, do not exist. Therefore, the staff finds that no further evaluation is required.

Loss of Material due to General, Pitting and Crevice Corrosion. The staff reviewed LRA Section 3.5.2.2.1.4 using the review procedures of SRP-LR Section 3.5.2.2.1.4.

LRA Section 3.5.2.2.1.4 addresses loss of material due to general, pitting and crevice corrosion for steel elements of accessible and inaccessible areas of containments, stating that the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program are used to manage aging of accessible Containment steel elements. For inaccessible areas, the applicant stated in the LRA that the loss of material due to corrosion is assured to be acceptable because (1) the design of the TMI-1 concrete in accordance with ACI 318-63 and construction in accordance with ACI 301-66 provide a good quality dense concrete with a low permeability, (2) the interior concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the containment liner, (3) the moisture barrier is monitored for aging effects by the ASME Section XI, Subsection IWE Program; this will be performed every refueling outage, and (4) IWE inspections have concluded that the existing liner corrosion is acceptable.

SRP-LR Section 3.5.2.2.1.4 states that loss of material due to general, pitting and crevice corrosion could occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. SRP-LR Section 3.5.2.2.1.4 further states that the existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. LRA Section B.2.1.24 describes the existing ASME Section XI, Subsection IWE program as consistent, with exception, with GALL AMP XI.S1 “ASME Section XI, Subsection IWE.” LRA Section B.2.1.27 describes the existing 10 CFR Part 50, Appendix J program as consistent with GALL AMP XI.S4 “10 CFR Part 50, Appendix J.” SRP-LR Section 3.5.2.2.1.4 also states that the GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant.

After reviewing the LRA, including the related AMPs with onsite basis document, related TMI-1 operating experience, and discussions with the applicant’s technical staff, the staff found that the liner thickness corrosion rate was noticeable from the operating experience of the ASME Section XI, Subsection IWE Program. From the LRA Section on the ASME Section XI, Subsection IWE Program, the staff also noted that the applicant committed to replacing the existing steam generators with new Once Through Steam Generators (OTSGs) prior to entering the period of extended operation. Repair/replacement of reactor building liner plate, removed for access purposes, will be done in accordance with ASME Section XI, Subsection IWE. During the onsite AMP audit, the applicant also indicated that the liner will be restored (weld repair) to full nominal thickness at all locations identified as below 90% before entering the extended operation period. In RAI B.2.1.24-2, dated October 7, 2008, the staff requested that the applicant provide additional information to confirm this and provide the proposed schedule for completion.

The staff’s review of the ASME Section XI, Subsection IWE Program including the applicant’s response to RAI B.2.1.24-2 is addressed and documented in the SER Section 3.0.3.2.19. The staff further noted from review of the 10 CFR Part 50, Appendix J Program that there were no instances of Appendix J test failures due to causes other than valve or flange seat leakage. For these failures, all conditions were evaluated and corrected in accordance with the 10 CFR Part 50, Appendix J program. The staff’s review of the 10 CFR Part 50, Appendix J is documented in SER Section 3.0.3.1.7.

On the basis of its review, the staff determines that loss of material due to general pitting and crevice corrosion is an aging effect for steel elements of accessible and inaccessible areas of containments for the period of extended operation. The staff finds that applicant's inspections and tests in accordance with the ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J Program to manage loss of material due to general pitting and crevice corrosion are adequate because (1) the aging effect has been effectively monitored and managed under the programs for accessible containment steel elements, and (2) containment concrete in contact with the embedded containment liner was designed, constructed, and inspected in accordance with applicable ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete, hence corrosion for inaccessible areas is not expected to be significant. Therefore, the staff agrees that no additional plant-specific program is required.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4. For those line items that apply to LRA Section 3.5.2.2.1.4, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.1.5 using the review procedures of SRP-LR Section 3.5.2.2.1.5.

In LRA Section 3.5.2.2.1.5, the applicant stated that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature is a TLAA for prestressed concrete containment.

SRP-LR Section 3.5.2.2.1.5 states that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

TMI-1 containment is prestressed concrete. Therefore, loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for the TMI-1 Containment is a TLAA defined in 10 CFR 54.3. The applicant's TLAA evaluation in accordance with 10 CFR 54.21(c) is discussed in LRA Section 4.7. The staff's review of the applicant's evaluation of this TLAA is documented in the SER Section 4.7.

Cumulative Fatigue Damage. The staff reviewed LRA Section 3.5.2.2.1.6 using the review procedures of SRP-LR Section 3.5.2.2.1.6.

In LRA Section 3.5.2.2.1.6, the applicant stated that the TLAA evaluation of metal fatigue for penetration bellows (Fuel transfer canal penetration) in accordance with 10 CFR 54.21(c) is discussed in LRA Section 4.5. Penetration sleeves and dissimilar welds are evaluated in LRA subsection 3.5.2.2.1.8.

SRP-LR Section 3.5.2.2.1.6 states that if included in the current licensing basis, fatigue analyses of suppression pool steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3.

SER Section 4.5 documents the staff's review of the applicant's TLAA evaluation of metal fatigue for penetration bellows.

Cracking due to Stress Corrosion Cracking (SCC). The staff reviewed LRA Section 3.5.2.2.1.7 using the review procedures of SRP-LR Section 3.5.2.2.1.7.

In LRA Section 3.5.2.2.1.7, the applicant stated that SCC is not an applicable aging effect for the TMI-1 containment penetration sleeves, penetration bellows, and dissimilar metal welds, since the penetration sleeves, penetration bellows, and dissimilar metal welds are not subject to an aggressive chemical environment.

SRP-LR Section 3.5.2.2.1.7 states that cracking due to SCC of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds could occur in all types of PWR and BWR containments. Cracking due to SCC could also occur in stainless steel vent line bellows for BWR containments. The existing program relies on the ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J Program to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect these aging effects for stainless steel penetration sleeves, penetration bellows and dissimilar metal welds, and stainless steel vent line bellows.

The staff acknowledged that stainless steel must be subject to both high temperature (greater than 140 °F) and an aggressive chemical environment to be susceptible to SCC. NUREG-1833 "Technical Bases for Revision to the license Renewal Guidance Documents" states "In general, SCC very rarely occurs in austenitic stainless steels below 140 °F. Although SCC has been observed in stagnant, oxygenated borated water systems at lower temperatures than this 140 °F threshold, all of these instances have identified a significant presence of contaminants (halogens, specifically chlorides) in the failed components. With a harsh enough environment (significant contamination), SCC can occur in austenitic stainless steel at ambient temperature. However, these conditions are considered event driven, resulting from a breakdown of chemistry controls." The staff noted that the containment penetration sleeves, penetration bellows, and dissimilar metal welds are not subject to an aggressive chemical environment. On the basis of its review, the staff agrees that cracking due to SCC for the containment penetration sleeves, penetration bellows, and dissimilar metal welds is not applicable to TMI-1 since the conditions necessary for SCC, both high temperature (greater than 140 °F) and exposure to an aggressive environment, do not simultaneously exist.

Cracking due to Cyclic Loading. The staff reviewed LRA Section 3.5.2.2.1.8 using the review procedures of SRP-LR Section 3.5.2.2.1.8.

In LRA Section 3.5.2.2.1.8, the applicant stated that the ASME Section XI, Subsection IWE as described in the LRA B.2.1.24, and 10 CFR 50, Appendix J as described in the LRA B.2.1.27 are used to manage cracking due to cyclic loading of the containment penetration sleeves including the closure plates. The applicant further stated that plant operating experience has not identified cracking of penetration sleeves or the closure plates as a concern and leakage through the reactor building during pressure testing conducted in accordance with 10 CFR Part 50, Appendix J, meets or exceeds TS requirements. In addition, the applicant stated that penetration bellows are evaluated for cumulative fatigue damage in LRA Section 3.5.2.2.1.6.

SRP-LR Section 3.5.2.2.1.8 states that cracking due to cyclic loading of suppression pool steel and stainless steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) could occur for all types of containments and BWR vent header, vent line bellows and downcomers. SRP-LR Section 3.5.2.2.1.8 also states that the existing program relies on the ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J Program to manage this aging effect. However, VT-3 visual inspection may not detect fine cracks. The GALL Report recommends further evaluation for detection of this aging effect.

The ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J Program are existing programs that are consistent with all elements of GALL AMP XI.S1, “ASME Section XI, Subsection IWE,” and GALL AMP XI.S4, “10 CFR Part 50, Appendix J,” respectively. The staff’s reviews of the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program are documented in SER Sections 3.0.3.2.19 and 3.0.3.1.7 respectively.

The staff reviewed the AMR and its associated AMPs. During the onsite review of the associated AMPs, the staff also interviewed applicant’s technical personnel. The staff confirmed that TMI-1 operating experience did not identify any events related to cyclic loading induced cracking of containment components. Metal fatigue for penetration bellows is a TLAA. SER Section 4.5 documents the staff’s review of the applicant’s TLAA evaluation.

On the basis of its review, the staff finds that applicant’s Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage the aging effect of cracking due to cyclic loading of steel, stainless steel elements and dissimilar welds in penetration sleeves agrees with the recommendation of the GALL Report. The staff also agrees that the applicant’s evaluation is acceptable since TMI-1 operating experience did not identify cracking of penetration sleeves or the closure plates as a concern.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.8. For those line items that apply to LRA Section 3.5.2.2.1.8, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Material (Scaling, Cracking, and Spalling) due to Freeze-Thaw. The staff reviewed LRA Section 3.5.2.2.1.9 using the review procedures of SRP-LR Section 3.5.2.2.1.9.

TMI-1 is located in an area in which weathering conditions are considered severe. The applicant stated in LRA Section 3.5.2.2.1.9 that the existing ASME Section XI, Subsection IWL Program is used to manage loss of material (scaling, cracking, and spalling) due to freeze-thaw of accessible containment concrete elements. For inaccessible areas, the applicant further stated that the aging effect is not significant and requires no aging management because its containment concrete structures were designed, constructed, and inspected in accordance with applicable ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. The applicant also committed in the LRA that inaccessible concrete will be inspected if exposed for any reason, as required by the Structures Monitoring Program.

SRP-LR Section 3.5.2.2.1.9 states that loss of material (scaling, cracking, and spalling) due to freeze-thaw could occur in PWR and BWR concrete containments. The SRP-LR also states that the existing program relies on ASME Section XI, Subsection IWL to manage this aging effect. The SRP-LR further states that the GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weathering conditions.

The LRA describes the existing ASME Section XI, Subsection IWL Program as consistent with GALL AMP XI S2 "ASME Section XI, Subsection IWL." The staff's review of the ASME Section XI, Subsection IWL Program is documented in SER Section 3.0.3.1.6.

The staff reviewed the LRA. The staff confirmed that the Section XI, Subsection IWL Program is credited for aging management of the aging effect for accessible containment concrete elements. The staff also noted that the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

The staff further found the concrete mix design addressed freeze-thaw damage potential by using low water-to-cement ratio and sufficient air content for structures subject to freezing and thawing. The staff noted that the air content of the containment concrete varied from 2.5 % to 8 %, which exceeds the GALL recommendation of 3% to 6%. However, according to ACI 201.2R "Guide to Durable Concrete," for concrete exposed to freezing and thawing, air content of 4.5 to 7.5 is recommended for severe exposure, and air content of 3.5 to 6 is recommended for moderate exposure. In addition, tolerance on air content of 1.5 % is allowed. Therefore, the staff found that the concrete is consistent with the air content recommendation of ACI 201.2R-77 for concrete resistant to freezing and thawing. In addition, the staff also noted that containment concrete has a water-to-cement ratio of 0.44 with a 5000 psi compressive strength. The staff confirmed that 0.44 water-to-cement ratio of TMI-1 containment concrete meets the recommendation of ACI 201.2R-77 for a water-to-cement ratio of less than 0.50 for a dense concrete with a low permeability.

On the basis of its review, the staff finds that loss of material (scaling, cracking, and spalling) due to freeze-thaw is not a significant aging effect for concrete elements of the containment because the absence of the significant aging effects is confirmed from the operating experience under the existing ASME Section XI, Subsection IWL Program. The staff also finds the applicant's evaluation acceptable because (1) the containment concrete is designed, constructed, and inspected in accordance with applicable ACI and ASTM standards and meets the intent of ACI 201.2R-77 as recommended by the GALL Report, and (2) the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.9. For those line items that apply to LRA Section 3.5.2.2.1.9 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide. The staff reviewed LRA Section 3.5.2.2.1.10 using the review procedures of SRP-LR Section 3.5.2.2.1.10.

In LRA Section 3.5.2.2.1.10, the applicant stated that the applicant's existing AMP ASME Section XI, Subsection IWL program is used to manage cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide for accessible TMI-1 Containment concrete elements.

For inaccessible areas, the applicant further evaluated that the cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide is not significant and requires no aging management because (1) TMI-1 containment concrete is designed and constructed to meet ACI and ASTM Standards and meets the intent of ACI 201.2R, and (2) aggregates were tested in accordance with ASTM Specifications C 29-60, C 40-66, C 127-59, C 128-59, and C 139-63 to confirm that the aggregates are not reactive. However, the applicant committed that inaccessible concrete will be inspected for cracking and increase in porosity and permeability if excavated for any reason, as required by the TMI-1 Structures Monitoring Program.

SRP-LR Section 3.5.2.2.1.10 states that cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide could occur in concrete elements of concrete and steel containments. SRP-LR Section 3.5.2.2.1.10 also states that the existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The LRA describes the existing ASME Section XI, Subsection IWL Program as consistent with GALL AMP XI.S2 "ASME Section XI, Subsection IWL." The staff's review of the ASME Section XI, Subsection IWL Program is documented in SER Section 3.0.3.1.6. The GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the LRA including the AMR and the associated AMPs. During the on-site review the staff also interviewed applicant's technical personnel. From review of the associated AMPs and operating experience, the staff confirmed that these aging effects are not significant at TMI-1. As discussed above in SER Sections 3.5.2.2.1.1 and 3.5.2.2.1.9, the TMI-1 containment concrete meets the recommendations of ACI 201.2R-77 as suggested by the GALL on water-to-cement ratio, air content, and aggregate reactivity issues.

On the basis of its review, the staff finds that cracking due to expansion and reaction with aggregate, increase in porosity and permeability due to leaching of calcium hydroxide are not plausible aging effects for concrete elements of containments because (1) the containment concrete is designed, constructed, and inspected in accordance with applicable ACI and ASTM standards meets the recommendations of ACI 201.2R-77, and (2) the absence of the aging effects is confirmed under the existing ASME Section XI, Subsection IWL Program as recommended by the GALL Report. Therefore, the staff concluded that, the applicant has met the criteria of SPR-LR Section 3.5.2.2.1.10 for further evaluation.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.10. For those line items that apply to LRA Section 3.5.2.2.1.10, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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.

Aging of Structures Not Covered by Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

In LRA Section 3.5.2.2.2.1, the applicant stated that the GALL structure Groups 2, 7, 8, and 9 do not exist. The Structures Monitoring Program described in the LRA is credited to manage aging effects applicable to Groups 1, 3, 4, and 5 structures. Even if the aging management review did not identify aging effects requiring management, accessible structures will be monitored through the Structures Monitoring Program. The applicant stated that aging effects not requiring management are (1) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide for Groups 1, 3, 4, and 5 structures, (2) loss of material and cracking due to freeze-thaw for Group 4 structures and (3) reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1, 3, 4, and 5 structures.

SRP-LR Section 3.5.2.2.2.1 states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, 9 structures; (2) increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, 9 structures; (3) loss of material due to corrosion for Groups 1-5, 7, 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5, 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3, 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the structures monitoring program. In addition, SRP-LR Section 3.5.2.2.2.1 also states that lock up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the Structures Monitoring Program or the ASME Section XI, Subsection IWF Program to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI (IWF) or structures monitoring program.

The staff noted the GALL structure Groups 2, 7, 8, and 9 do not exist. The staff further noted that the applicant's Structures Monitoring Program is credited for aging management of these effects/mechanisms for the affected concrete structures and structural components even if the aging management review did not identify aging effects requiring management. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21.

Additional reviews of specific aging effects/mechanisms are discussed below.

(1) Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, and 9 Structures

The staff's reviews for cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for inaccessible concrete areas of containments, below-grade inaccessible concrete areas of Groups 1, 3, and 5 structures, and below-grade inaccessible concrete areas of Group 6 Structures are documented in SER Sections 3.5.2.2.1.1, 3.5.2.2.2.2.4, and 3.5.2.2.2.4.1 respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. The staff confirmed that Groups 1 and 3-5, structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) subject to this AMR are all in-scope of the Structures Monitoring Program.

Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(2) Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, and 9 Structures

The staff's reviews for increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for inaccessible concrete areas of containments, below-grade inaccessible concrete areas of Groups 1, 3, and 5 structures, and below-grade inaccessible concrete areas of Groups 6 Structures are documented in SER Sections 3.5.2.2.1.1, 3.5.2.2.2.2.4, and 3.5.2.2.2.4.1, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. The staff confirmed that Groups 1 and 3-5, structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(3) Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

The staff's review for loss of material due to general, pitting and crevice corrosion for steel elements of containments is documented in SER Section 3.5.2.2.1.4. The staff's review of the Structures Monitoring Program is documented in SER Sections 3.0.3.2.21. The staff finds that Groups 1, and 3-5 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(4) Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7-9 Structures

The staff's reviews for loss of material (spalling, scaling) and cracking due to freeze-thaw for concrete containments, below-grade inaccessible concrete areas of Groups 1, 3, and 5 structures, and below-grade inaccessible concrete areas of Groups 6 Structures are documented in SER Sections 3.5.2.2.1.9, 3.5.2.2.2.2.1 and 3.5.2.2.2.4.2, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. The staff found that this is not an applicable aging effect for Group 4 structures because Group 4 structures are inside the Reactor Building and protected from repeated freeze-thaw. The staff confirmed that Groups 1, 3 and 5 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(5) Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5 and 7-9 Structures

The staff's reviews for cracking due to expansion and reaction with aggregates for concrete elements of containments, below-grade inaccessible areas of Groups 1, and 3-5 structures, and below–grade inaccessible reinforced concrete areas of Groups 6 structures are documented in SER Sections 3.5.2.2.1.10, 3.5.2.2.2.2.2, and 3.5.2.2.2.4.3 respectively. The staff's review of the Structures Monitoring Program is documented in

SER Section 3.0.3.2.21. The staff finds that Groups 1, and 3-5 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(6) Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

The staff's reviews for cracks and distortion due to increased stress levels from settlement for containment and below-grade inaccessible areas of Groups 1, and 3, and 5 structures are documented in SER Sections 3.5.2.2.1.2 and 3.5.2.2.2.2.3, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. The staff finds that Groups 1, 3, 5, and 6 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(7) Reduction in Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3 and 5-9 Structures

The staff's reviews for reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for containment and below-grade inaccessible areas of Groups 1, and 3, and 5 structures are documented in SER Sections 3.5.2.2.1.2 and 3.5.2.2.2.2.3, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. The staff determined through reviews that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1, 3, 5, and 6 structures are not plausible aging effects due to the absence of porous concrete subfoundation. The staff noted that even if the aging management review did not identify aging effects requiring management, accessible structures will be monitored through the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required

(8) Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

SRP-LR Section 3.5.2.2.2.1 also states that lockup due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the Structures Monitoring Program and ASME Section XI, Subsection IWF to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI (IWF) or Structures Monitoring Program.

In LRA Section 3.5.2.2.2.1, the applicant stated that RPV support shoes and steam generator supports do not include sliding surfaces. The Structures Monitoring Program and the ASME Section XI, Subsection IWF program are used to manage lock-up due to wear for the sliding surfaces provided for supports for Main Steam relief valves, heat exchanger supports, and floor beam seats.

On the basis of its review, the staff concludes that no further evaluation is required for lock up due to wear because the structure/aging effect combinations are within the applicant's Structures Monitoring Program and ASME Section XI, Subsection IWF program.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Aging Management of Inaccessible Areas</u>. The staff reviewed LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.

(1) TMI-1 is located in an area in which weathering conditions are considered severe. The applicant stated in LRA Section 3.5.2.2.2.2.1 that loss of material (scaling, cracking, and spalling) due to freeze-thaw in below-grade inaccessible concrete areas for structure Groups 1, 3, and 5 (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) is not significant and requires no aging management because concrete structures at TMI-1 were designed, constructed, and inspected in accordance with applicable ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. The TMI-1 concrete mix design addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing and thawing. However, the applicant committed that inaccessible concrete will be inspected if exposed for any reason, as required by TMI-1 Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.2.1, which states that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures for plants located in moderate to severe weathering conditions.

The staff reviewed the LRA. The staff noted that the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation. The staff further noted the TMI-1 concrete mix design addressed freeze-thaw damage potential by using sufficient air content for structures subject to freezing and thawing. The staff found that the air content of TMI-1 containment concrete varied from 2.5% to 8%, which exceeds the GALL recommendation of 3% to 6%. However, according to ACI 201.2R "Guide to Durable Concrete," for concrete exposed to freezing and thawing, air content of 3.5 to 7.5 is recommended. In addition, tolerance on air content of 1.5% is allowed. Therefore, the staff found that the TMI-1 concrete is consistent with the air content recommendations of ACI 201.2R-77 for concrete resistant to freezing and thawing.

On the basis of its review, the staff agrees that for TMI-1, loss of material (scaling, cracking, and spalling) due to freeze-thaw is not a significant aging effect for inaccessible areas for structure Groups 1, 3, and 5 because the absence of the significant aging effects is confirmed from the operating experience under the existing

Structures Monitoring Program. The staff also finds the applicant's evaluation acceptable because (1) the TMI-1 concrete mix design addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing and thawing in accordance with applicable ACI and ASTM which meet the intent of ACI 201.2R-77 for moderate to severe exposure as recommended by the GALL, and (2) the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.2.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) In LRA Table 3.5.1, Item 3.5.1-27, the applicant stated that the existing Structures Monitoring Program is used to manage cracking of interior/exterior concrete due to expansion and reaction with aggregate for accessible and inaccessible areas regardless of aging mechanism. For below-grade inaccessible concrete areas, the applicant further evaluated in LRA Section 3.5.2.2.2.2.2 that the cracking due to expansion and reaction with aggregate is not significant and requires no aging management because (1) The containment concrete is designed and constructed to meet ACI and ASTM Standards and meets the intent of ACI 201.2R, and (2) aggregates were tested in accordance with ASTM Specifications C 29-60, C 40-66, C 127-59, C 128-59, and C 139-63 to confirm that the aggregates meet ACI requirements. However, the applicant committed that inaccessible concrete will be inspected for cracking if excavated for any reason, as required by the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.2, which states that cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the LRA including the AMR and the associated Structures Monitoring Program. The staff noted from NUREG-1611 "Aging Management of Nuclear Power Plant Containment for License Renewal" that reaction with aggregates in inaccessible areas would also occur in accessible areas because aggregates were used in construction of both accessible and inaccessible areas. The existing Structures Monitoring Program requires periodic examination of accessible concrete surfaces and inspection of inaccessible concrete areas for cracking if excavated for any reason.

On the basis of its review, the staff agrees that cracking due to expansion and reaction with aggregate is not a significant aging effect for concrete elements because the absence of the significant aging effects is confirmed from the operating experience under the existing Structures Monitoring Program. The staff also finds the applicant's evaluation acceptable because (1) the aggregates were tested in accordance with ASTM Specifications, (2) the Structures Monitoring Program will detect the aging effects in the accessible areas, which will trigger additional evaluation of accessible and inaccessible areas, and (3) the inaccessible areas will be examined by the Structures Monitoring Program when the areas are available for inspection due to future excavation.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.2. For those line items that apply to LRA Section 3.5.2.2.2.2.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) The applicant stated in the LRA Section 3.5.2.2.2.2.3 that (1) the foundation of structure Groups 1, 4, and 5 is founded on bedrock and no settlement has been experienced, Group 3 structures whose foundations are founded on soil are subject to cracks and distortion due to increased stress levels from settlement and in scope of the Structures Monitoring Program, (2) the foundation is not constructed of porous concrete, and (3) the plants design does not employ a de-watering system for control of settlement.

The staff reviewed LRA Section 3.5.2.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.2.3, which states that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. LRA Section 3.5.2.2.2.2.3 states that the existing program relies on the Structures Monitoring Program to manage these aging effects. The TMI-1 Structures Monitoring Program described in LRA Section B.2.1.28 is an existing program that is consistent with all elements of the Structures Monitoring Program in the GALL, when the enhancements are incorporated in the program. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.21. SRP-LR Section 3.5.2.2.2.2.3 further states that the GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

The staff has reviewed the LRA including the AMR and its associated AMP. The staff confirmed that the TMI-1 base foundation is not constructed of porous concrete below grade. The staff further confirmed that the associated AMP Structures Monitoring Program is credited for aging management of these effects for the affected concrete structures and structural components, and will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible during excavation.

On the basis of its review, the staff finds that cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking and differential settlement due to erosion of porous concrete subfoundations are not plausible aging effects in below-grade inaccessible concrete areas of Groups 1 and 5 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) because conditions necessary for the aging effects, such as a soil environment as described in associated AMR line items of the GALL Report, Volume 2, do not exist. The staff also finds that these aging effects could affect TMI-1 concrete area of Group 3 structures whose foundation is founded on soil. However, the applicant's Structures Monitoring Program is credited for aging management of these effects for the affected concrete structures and structural components for structure Group 3. Therefore, the staff finds that no further evaluation is required.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.3. For those line items that apply to LRA Section 3.5.2.2.2.2.3, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21 (a)(3).

(4) The applicant stated that inaccessible below-grade reinforced concrete for Group 1, 3, and 5 structures is not subject to an aggressive environment because historical chemistry results of groundwater water samples have confirmed that groundwater is non-aggressive. Groundwater water is periodically monitored as required by the Structures Monitoring Program. The applicant committed to perform examinations of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

The staff reviewed LRA Section 3.5.2.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.2.4, which states that increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of plant specific programs to manage the aging effects for inaccessible areas if the environment is aggressive.

To ensure non-aggressive groundwater chemistries, the GALL Report suggests the performance of periodic groundwater inspection for chlorides, sulfates, and pH. The staff noted that the applicant's groundwater inspection program is performed by the applicant's Structures Monitoring Program described in LRA Section B.2.28. The staff's review of the applicant's Structures Monitoring Program, including periodic monitoring of groundwater, is documented in SER Section 3.0.3.2.21.

The staff reviewed the LRA including the AMR and its associated AMP. The staff noted that the sampling results from 1996 presented in the LRA, which indicated a groundwater pH range of 6.1-6.7, a chloride range of 3.5-210 ppm, and a sulfate range of 14.1-410 ppm. In RAI B.2.1.28-1, dated October 7, 2008, the staff requested that the applicant provide additional information concerning the frequency of periodic sampling and the results for the last two sampling of groundwater.

In its response to the RAI dated October 30, 2008, the applicant stated that the groundwater sampling for pH, chloride, and sulfate concentrations will be performed every 5 years during the period of extended operation. The applicant also demonstrated the last two groundwater samplings include one sample taken in 2007 and three taken in 2005, which showed a pH range of 7.4-7.8, a chloride range of 42.4-65.5 ppm, and a sulfate range of 27-53.3. The staff confirmed that the below-grade environment at TMI-1 is non-aggressive (pH greater than 5.5, Chlorides less than 500 ppm, and Sulfates less than 1500 ppm). The staff's concern described in RAI B.2.1.28-1 is resolved.

On the basis of its review, the staff finds that the AMR results consistent with the GALL Report. The staff agrees that a plant specific aging management program is not required for below-grade inaccessible concrete areas of the TMI-1 Group 1, 3, and 5 (structure Groups 2, 7, 8, and 9 do not exist) structures to manage aging effects of increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel because (1) the groundwater water environment is confirmed not aggressive to concrete; (2) the inspection frequency of groundwater chemistries as required by the Structures Monitoring Program agrees with the recommendation of the GALL; and (3) the applicant committed to perform examinations of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.4. For those line items that apply to LRA Section 3.5.2.2.2.2.4, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(5) In LRA Section 3.5.2.2.2.2.5, the applicant stated that the cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide in below-grade inaccessible concrete areas requires no aging management because (1) the concrete is designed and constructed to meet ACI and ASTM Standards and meets the intent of ACI 201.2R, and (2) the aggregates were tested in accordance with ASTM Specifications C 29-60, C 40-66, C 127-59, C 128-59, and C 139-63 to confirm that the aggregates meet ACI requirements.

The staff reviewed LRA Section 3.5.2.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.2.5, which states that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. SRP-LR states that the GALL Report Section 3.5.2.2.2.2.5 recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The GALL Report states that an aging management program is not necessary for inaccessible areas, even if reinforced concrete is exposed to flowing water, if there is documented evidence that confirms the in-place concrete was constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the LRA. The staff noted that concrete structures are designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66. The Portland cement conforms to ASTM C-150, Type II, modified for low heat of hydration. Neither calcium chloride nor any admixtures containing calcium chloride or other chlorides, sulfides, or nitrates were used.

The staff also noted that leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water; however, the TMI-1 concrete components below grade for Groups 1, 3, 4, and 5 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) are not exposed to flowing water.

On the basis of its review, the staff agrees that increase in porosity and permeability due to leaching of calcium hydroxide are not applicable aging effects for concrete elements of Groups 1, 3, 4, and 5 structures (structure Groups 2, 7, 8, and 9 do not exist at TMI-1) because the concrete components below grade are not exposed to flowing water.

Therefore, managing the effect of increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are not required for concrete in inaccessible areas.

Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3.

The applicant stated in LRA Section 3.5.2.2.2.3 that Group 1, 3-5 concrete structures are maintained below the 150 °F threshold for general areas and under 200 °F for local areas.

SRP-LR Section 3.5.2.2.2.3 states that reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1-5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. SRP-LR Section 3.5.2.2.2.3 also states the GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits, i.e., general area temperature greater than 66 °C (150 °F) and local area temperature greater than 93 °C (200 °F).

The staff reviewed the LRA and found that no portion of the in-scope concrete structures and concrete at TMI-1 exceeds specified temperature limits, which are 150 °F for general area and 200 °F for local area. Therefore, this aging effect is not applicable to TMI-1.

On the basis of its review, the staff finds that reduction of strength and modulus of concrete due to elevated temperatures are not applicable aging effects to TMI-1 because the conditions necessary for the aging effects, elevated temperatures, do not exist. Therefore, the staff finds that no further evaluation is required.

Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.4.

SRP-LR Section 3.5.2.2.2.4 states that the GALL Report recommends further evaluation for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with the GALL Report, 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.

The staff's review and evaluation of aging management of inaccessible areas for Group 6 structures are addressed as follows.

(1) LRA Section 3.5.2.2.2.4.1 states that for inaccessible below-grade reinforced concrete for Group 6 structures, a plant specific aging management program is not required to manage the aging effects of increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel because the environment is not aggressive, which is confirmed by the historical groundwater test results. A representative sample of below-grade concrete will be inspected, if excavated for any reason, and periodic groundwater monitoring will be done as required by the Structures Monitoring Program.

    The staff reviewed LRA Section 3.5.2.2.2.4.1 against the criteria in SRP-LR Section 3.5.2.2.2.4.1, which states that increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of plants-specific programs to manage these aging effects in inaccessible areas if the environment is aggressive.

The staff has reviewed the LRA including the AMR and associated AMP. The staff confirmed that the containment concrete structures are designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66. From inspection results, the staff also validated that the groundwater chemistry at TMI-1 is not aggressive. The staff noted that the applicant's groundwater inspections are performed under the applicant's Structures Monitoring Program. The staff's review of the Structures Monitoring Program including periodic monitoring of groundwater is documented in SER Section 3.0.3.2.21.

On the basis of its review, the staff finds that the Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures are not plausible aging effects because (1) the inspections of groundwater and raw water chemistries confirm that the environment is not aggressive; (2) the inspection frequency of groundwater chemistries as required by the Structures Monitoring Program agrees with the recommendation of the GALL Report; and (3) the applicant committed to perform examinations of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible through excavation, therefore, the staff finds that no further evaluation is required.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.1. For those line items that apply to LRA Section 3.5.2.2.2.4.1 the staff determined that the that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) TMI-1 is located in an area in which weathering conditions are considered severe. For below-grade inaccessible concrete areas for Structure Group 6, the applicant stated in LRA Section 3.5.2.2.2.4.2 that the loss of material (scaling, cracking, and spalling) due to freeze-thaw is not significant and requires no aging management because concrete structures at TMI-1 were designed, constructed, and inspected in accordance with applicable ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. The TMI-1 concrete mix design addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing and thawing. However, the applicant committed to inspect inaccessible concrete if exposed for any reason, as in accordance with the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.2.4.2 against the criteria in SRP-LR Section 3.5.2.2.2.4.2, which states that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.

The staff noted that the applicant's Structures Monitoring Program, which requires periodic visual inspection, will be used to manage loss of material (spalling, scaling) and cracking due to freeze-thaw in accessible areas of water-control structures (Group 6 structures.) The staff also noted that the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible during excavation. In NUREG-1611, the staff notes that any freeze-thaw degradation would initially appear in the exposed concrete structure.

The staff further found the concrete mix design addressed freeze-thaw damage potential by using sufficient air content for structures subject to freezing and thawing. The staff noted that the air content of containment concrete varied from 2.5% to 8%, which exceeds the GALL recommendation of 3% to 6%. However, according to ACI 201.2R "Guide to Durable Concrete," for concrete exposed to freezing and thawing, air content of 3.5 to 7.5 is recommended. In addition, tolerance on air content of 1.5% is allowed. Therefore, the staff found that the TMI-1 concrete is consistent with the air contents recommendation of ACI 201.2R-77 for concrete resistant to freezing and thawing.

On the basis of its review, the staff agrees that loss of material (scaling, cracking, and spalling) due to freeze-thaw is not a significant aging effect for below-grade inaccessible concrete areas of Group 6 structures because the absence of significant aging effects is confirmed from the operating experience under the existing Structures Monitoring Program. The staff also finds the applicant's evaluation acceptable because (1) the TMI-1 concrete mix design addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing and thawing in accordance with applicable ACI and ASTM standards and meets the intent of ACI 201.2R-77 for moderate to severe exposure as recommended in the GALL Report; (2) the Structures Monitoring Program will include examination of the accessible concrete structures for age-related degradation; and (3) the applicant will examine the inaccessible areas during any future excavations in accordance with the provisions of the applicant's Structures Monitoring Program.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.2. For those line items that apply to LRA Section 3.5.2.2.2.4.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) In LRA Section 3.5.2.2.2.4.3, the applicant stated that the Structures Monitoring Program will be used to manage cracking due to expansion and reaction with aggregate, and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide of reinforced concrete in accessible areas of water-control structures (Group 6 structures). The applicant evaluated these aging effects, stating that they are not significant in below-grade inaccessible reinforced concrete areas of Group 6 structures and requires no aging management because (1) the concrete is designed and constructed to meet ACI and ASTM Standards and meets the intent of ACI 201.2R, and (2) the aggregates were tested in accordance with ASTM Specifications C 29-60, C 40-66, C 127-59, C 128-59, and C 139-63 to confirm that the aggregates meet ACI requirements. However, the applicant has committed to inspect the inaccessible

concrete structures for cracking and increase in porosity and permeability if excavated for any reason, in accordance with the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.2.4.3 against the criteria in SRP-LR Section 3.5.2.2.2.4.3, which states that cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the LRA including the AMR and the associated AMP Structure Monitoring Program. In NUREG-1611, the staff notes that reaction with aggregates in inaccessible areas would also occur in accessible areas because the same aggregates were used in construction of both accessible and inaccessible areas. The existing Structure Monitoring Program requires periodic examination of accessible concrete surfaces and inspection of inaccessible concrete areas for cracking if excavated for any reason.

On the basis of its review, the staff agrees that cracking due to expansion and reaction with aggregate is not a significant aging effect for in below-grade inaccessible reinforced concrete areas of Group 6 structures because the absence of the significant aging effects is confirmed from the operating experience under the existing Structure Monitoring Program. The staff also finds that the applicant's evaluation acceptable because (1) the aggregates were tested in accordance with ASTM Specifications, and (2) the Structures Monitoring Program includes periodic examination of accessible concrete surfaces, and (3) examination of the exposed concrete areas when a below-grade concrete component becomes accessible through excavation.

The GALL Report states that an aging management program is not necessary for inaccessible areas, even if reinforced concrete is exposed to flowing water, if there is documented evidence that confirms the in-place concrete was constructed in accordance with the recommendations in ACI 201.2R-77. The staff noted that the TMI-1 concrete structures are designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66. The Portland cement conforms to ASTM C-150, Type II, modified for low heat of hydration. Neither calcium chloride nor any admixtures containing calcium chloride or other chlorides, sulfides, or nitrates were used. The staff also noted from the AMR results in LRA Tables 3.5.2-6 "Dike/Flood Control System" and 3.5.2-8 "Intake Screen and Pump House" that the below-grade inaccessible reinforced concrete areas of Group 6 structures are not exposed to flowing water.

On the basis of its review, the staff agrees that increase in porosity and permeability due to leaching of calcium hydroxide is not a significant aging effect for below-grade inaccessible reinforced concrete areas of Group 6 structures because the concrete components below grade are not exposed to flowing water. Therefore, managing the effect of increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are not required for concrete in inaccessible areas.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.3. For those line items that apply to LRA Section 3.5.2.2.2.4.3 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion. The staff reviewed LRA Section 3.5.2.2.2.5 using the review procedures of SRP-LR Section 3.5.3.2.2.5.

In LRA Section 3.5.2.2.2.5, the applicant stated that it does not have Group 7 and 8 stainless steel tank liners.

SRP-LR Section 3.5.2.2.2.5 states that cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects.

The staff's review of the LRA indicated that TMI-1 does not have Group 7 and 8 stainless steel tank liners. Therefore, this AMR is not applicable to TMI-1.

On the basis of its review, the staff finds that cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion that could occur for Group 7 and 8 stainless steel tank liners exposed to standing water are not applicable since there are no Group 7 and 8 stainless steel tank liners at TMI-1.

Aging of Supports Not Covered by Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.2.6 using the review procedures of SRP-LR Section 3.5.3.2.2.6.

In Items 3.5.1-39, 3.5.1-40 and 3.5.1-41 of LRA Table 3.5.1, the applicant stated that the Structures Monitoring Program is used to manage (1) loss of material due to general and pitting corrosion for support members; welds; bolted connections; support anchorage to building structure, (2) reduction in concrete anchor capacity due to local concrete degradation/service-induced cracking or other concrete aging mechanisms in building concrete at locations of expansion and grouted anchors; grout pads for support base plates, and (3) reduction or loss of isolation function/radiation hardening, temperature, humidity, sustained vibratory loading for vibration isolation elements. Therefore, the applicant provided no further evaluation.

SRP-LR Section 3.5.2.2.2.6 states that the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

The staff has reviewed the LRA. The staff confirmed that the component support/aging effect combinations of (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports; are all covered by the

Structures Monitoring Program. Therefore, the staff determined that no further evaluation is required.

Based on a review of the programs identified above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.6. For those line items that apply to LRA Section 3.5.2.2.2.6 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cumulative Fatigue Damage due to Cyclic Loading. The staff reviewed LRA Section 3.5.2.2.2.7 using the review procedures of SRP-LR Section 3.5.3.2.2.7.

In LRA Section 3.5.2.2.2.7, the applicant stated that TMI-1 current licensing basis contains no fatigue analysis for component supports members, anchor bolts, and welds of Groups B1.1, B1.2, and B1.3 component supports.

SRP-LR Section 3.5.2.2.2.7 states that fatigue of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a CLB fatigue analysis exists. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

The staff has reviewed the LRA Section 3.5.2.2.2.7. The staff noted that no fatigue analyses were identified as TLAAs because there is no CLB fatigue analysis for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3. Therefore, cumulative fatigue damage due to cyclic loading for Groups B1.1, B1.2, and B1.3 component supports is not a TLAA as defined in 10 CFR 54.3.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's QA program.

3.5.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.5.2-1 through 3.5.2-20, the staff reviewed additional details of 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 3.5.2-20, the applicant indicated, via 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 concerning how the aging effects will be managed. 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 had demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.5.2.3.1 Structures and Component Supports – Air Intake Structure – 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 air intake structures component groups.

In LRA Table 3.5.2-1, the applicant identified 65 unique component/material/environment/aging effect/AMP groups for the Air Intake Structures. Forty three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to LRA Table 1 and the GALL Report Volume II line items are appropriate.

For ten component types, the applicant proposed to manage reinforced concrete material, aging effect increase in porosity and permeability, loss of strength/leaching of calcium hydroxide, and cracking, loss of bond, and loss of material by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note G. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of strength/leaching of calcium hydroxide in each case. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 2, states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For six component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Air Intake Structures not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Structures and Component Supports – Auxiliary Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the auxiliary building component groups.

In LRA Table 3.5.2-2, the applicant identified 113 unique component/material/environment/aging effect/AMP groups for the Auxiliary Building. Ninety-eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For eight component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "The aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every 5 years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Auxiliary Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.3 Structures and Component Supports – Circulating Water Pump House – 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 circulating water pump house component groups.

In LRA Table 3.5.2-3, the applicant identified 71 unique component/material/environment/aging effect/AMP groups for the Circulating Water Pump House. Fifty-six have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect increase in porosity and permeability, loss of strength/leaching of calcium hydroxide, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note G. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of strength/leaching of calcium hydroxide. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 2, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "The aging effects/mechanisms of above grade exterior concrete in a water-flowing environment include cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Structures Monitoring Program." The staff finds that the credited AMP is appropriate because the Structures Monitoring Program requires visual inspections on a periodic basis to manage cracking, loss of bond and loss of material due to corrosion of embedded steel. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposes no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "The aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Circulating Water Pump House not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.4 Structures and Component Supports – Control Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the control building component groups.

In LRA Table 3.5.2-4, the applicant identified 75 unique component/material/environment/aging effect/AMP groups for the Control Building. Fifty-nine have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For nine component types, the applicant proposed no aging management program to manage GALL Item III.A1-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "The aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Control Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.5 Structures and Component Supports – Diesel Generator Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the diesel generator building component groups.

In LRA Table 3.5.2-5, the applicant identified 59 unique component/material/environment/aging effect/AMP groups for the Diesel Generator Building. Fifty-six have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For one component type, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 2, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) and cracking due to freeze-thaw. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Diesel Generator Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.6 Structures and Component Supports – Dike/Flood Control System – Summary of Aging Management Evaluation – LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the dike/flood control system component groups.

In LRA Table 3.5.2-6, the applicant identified 39 unique component/material/environment/aging effect/AMP groups for the Dike/Flood Control System. Thirty-three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 4, which states "the aging effects/mechanisms of above grade exterior concrete in a water-flowing environment include cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Structures Monitoring Program." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of bond and loss of material (spalling, scaling) due to corrosion of embedded steel. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed no aging management program to manage GALL Item III.A6-3 (reinforced concrete material, item 3.5.1-34), aging effect none. These line items reference Note I and plant-specific Note 2, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Dike/Flood Control System not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.7 Structures and Component Supports – Fuel Handling Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the fuel handling building component groups.

In LRA Table 3.5.2-7, the applicant identified 107 unique component/material/environment/aging effect/AMP groups for the Fuel Handling Building. Ninety have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 4, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For eight component types, the applicant proposes no aging management program to manage GALL Item III.A5-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed no aging management program to manage GALL Item III.A5-13 (stainless steel fuel pool liner material, item 3.5.1-46), aging effect none. These line items reference Note I and plant-specific Note 3, which states "Stress corrosion cracking is not applicable since the spent fuel pool temperature is less than 140 °F." The staff reviewed the applicant's basis documents and the UFSAR, and found the spent fuel pool temperature is less than 140 °F. Therefore, stress corrosion cracking is not applicable. For loss of material/pitting and crevice corrosion, the applicant is using the Water Chemistry Program to manage GALL Item III.A5-13 (stainless steel fuel pool liner material, item 3.5.1-46). The staff's review of the Water Chemistry Program is documented in SER Section 3.0.3.2.2. The staff finds that the credited AMP is appropriate, because the Water Chemistry Program monitors and controls the chemical environments of the TMI-1 primary cycle and secondary cycle systems such that aging effects of system components are minimized. Aging effects include loss of material/pitting and crevice corrosion. Since the applicant has committed to use the appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Fuel Handling Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.8 Structures and Component Supports – Intake Screen and Pump House – Summary of Aging Management Evaluation – LRA Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the intake screen and pump house component groups.

In LRA Table 3.5.2-8, the applicant identified 111 unique component/material/environment/aging effect/AMP groups for the Intake Screen and Pump House. Ninety-one have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For five component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling/scaling/corrosion of embedded steel, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note G and plant-specific Note 7, which states "the aging effects/mechanisms of interior concrete in a water-flowing environment include cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Structures Monitoring Program." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) due to corrosion of embedded steel. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For five component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 5, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For four component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 6, which states "the aging effects/mechanisms of above grade exterior concrete in a water-flowing environment include cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Structures Monitoring Program." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) due to corrosion of embedded steel. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For five component types, the applicant proposed no aging management program to manage GALL Item III.A6-3 (reinforced concrete material, item 3.5.1-34), aging effect none. These line items reference Note I and plant-specific Note 2, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Intake Screen and Pump House not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.9 Structures and Component Supports – Intermediate Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the intermediate building component groups.

In LRA Table 3.5.2-9, the applicant identified 118 unique component/material/environment/aging effect/AMP groups for the Intermediate Building. Eighty-nine have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For fourteen component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note G. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of bond and loss of material (spalling, scaling) due to corrosion of embedded steel. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For seven component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For seven component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "The aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Intermediate Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.10 Structures and Component Supports – Mechanical Draft Cooling Tower Structures – Summary of Aging Management Evaluation – LRA Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the mechanical draft cooling tower structures component groups.

In LRA Table 3.5.2-10, the applicant identified 52 unique component/material/environment/aging effect/AMP groups for the Mechanical Draft Cooling Tower Structures. Thirty-two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel and increase in porosity and permeability, loss of strength/leaching of calcium hydroxide, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note G. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) due to corrosion of embedded steel and increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For eleven component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures

Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case because the Structures Monitoring Program performs visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Mechanical Draft Cooling Tower Structures not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.11 Structures and Component Supports – Miscellaneous Yard Structures – Summary of Aging Management Evaluation – LRA Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the miscellaneous yard structures component groups.

In LRA Table 3.5.2-11, the applicant identified 74 unique component/material/environment/aging effect/AMP groups for the Miscellaneous Yard Structures. Fifty-eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For eight component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 2, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For eight component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Miscellaneous Yard Structures not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.12 Structures and Component Supports – Natural Draft Cooling Tower – Summary of Aging Management Evaluation – LRA Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the natural draft cooling tower component groups.

In LRA Table 3.5.2-12, the applicant identified 28 unique component/material/environment/aging effect/AMP groups for the Natural Draft Cooling Tower. Twenty-two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of above grade exterior concrete in a water-flowing environment include cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel. These aging effects/mechanisms are managed by the Structures Monitoring Program." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of bond and loss of material (spalling, scaling) due to corrosion of embedded steel. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 4, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures

Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Natural Draft Cooling Tower not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.13 Structures and Component Supports – Structural Commodities – Summary of Aging Management Evaluation – LRA Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the structural commodities component groups.

In LRA Table 3.5.2-13, the applicant identified 109 unique component/material/environment/aging effect/AMP groups for the structural commodities. Eighty-eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For one component type, the applicant proposed to manage aluminum (insulation jacketing) material, aging effect loss of material/pitting and crevice corrosion, by using the External Surfaces Monitoring Program. The staff's review of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.16. These line items reference Note H, and plant-specific Note 4, which states "the aging effects of aluminum in this environment include loss of material due to pitting and crevice corrosion. These aging effects/mechanisms are managed by the External Surfaces Monitoring Program." The staff finds that the External Surfaces Monitoring Program requires visual inspections on a periodic basis to manage loss of material due to pitting and crevice corrosion; therefore, the credited AMP is appropriate in each case. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For eight component types, the applicant proposed to manage grout material, aging effect cracking/shrinkage and aggressive environment, by using the Structures Monitoring Program.

The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H, and plant-specific Note 6, which states "the aging effects/mechanisms of grout in this environment include cracking due to shrinkage and aggressive environment. These aging effects/mechanisms are managed by the Structures Monitoring Program." The staff finds that the Structures Monitoring Program requires visual inspections on a periodic basis to manage cracking due to shrinkage and aggressive environments; therefore the credited AMP is appropriate in each case. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage PVC (conduit) material, aging none, and none for management program. The staff reviewed the LRA, license design basis documents, EPRI 1002950 Structural Tools, Revision 1, August 2003, and the GALL Report and found that these materials do not perform or support any license renewal intended functions that satisfy the scoping criteria of 10 CFR 54.4(a). Therefore, aging management for these materials is not required.

For eleven component types, the applicant proposed to manage asbestos, calcium silicate, fiberglass, and Nukon® (insulation) material, aging none, and none for management program. The staff reviewed the LRA, license design basis documents, EPRI 1002950 Structural Tools, Revision 1, August 2003, and the GALL Report and found that these materials do not perform or support any license renewal intended functions that satisfy the scoping criteria of 10 CFR 54.4(a). Therefore, aging management for these materials is not required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Structural Commodities not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.14 Structures and Component Supports – Reactor Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the reactor building (containment) component groups.

In LRA Table 3.5.2-14 the applicant identified 352 unique component/material/environment/aging effect/AMP groups for the Reactor Building (Containment). Three hundred have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage epoxy material, aging effect loss of sealing/deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants), by using the 10 CFR Part 50, Appendix J Program. The staff's review of the 10 CFR Part 50, Appendix J Program is documented in SER Section 3.0.3.1.7. These line items reference Note F. The staff finds that the 10 CFR Part 50, Appendix J Program performs the containment leakage testing on a periodic basis to manage loss of sealing/deterioration of seals, gaskets, and moisture barriers; therefore, the credited AMP is appropriate in each case. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 7, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For five component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 2, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For seven component types, the applicant proposed no aging management program to manage GALL Item II.A1-4 (reinforced concrete material, item 3.5.1-1), aging effect none. These line items reference Note I and plant-specific Note 2, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For twenty-two component types, the applicant proposed to manage carbon steel; dissimilar metal welds (3.5.1-18) materials, aging effect loss of material general corrosion, by using ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J programs. The staff's review of the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J Programs are documented in SER Section 3.0.3.2.19 and 3.0.3.1.7 respectively. These line items reference Note I and plant-specific Note 6, which states "loss of material due to pitting and crevice corrosion is not applicable for this material and environmental combination." The staff finds that the credited AMPs are appropriate, because the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J Programs require visual inspections and pressure testing on a periodic basis to manage loss of material general corrosion. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For thirteen component types, the applicant proposed no aging management program to manage stainless steel; dissimilar metal welds (3.5.1-10 {II.A3-2}) material, aging effect none. These line items reference Note I and plant-specific Note 12, which states "Stress corrosion cracking is not applicable to stainless steel; dissimilar metal welds in environments of air with borated water leakage and air-indoor." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. On December 11, 2008, the staff asked the applicant to provide the technical basis for not following the GALL Report recommendation (RAI 3.5.2-14-0).

In the response e-mail dated December 12, 2008 (ML083500505) the applicant stated that the TMI-1 line items listed (3.5.1-10 {II.A3-2}) do not have an associated aging management program credited because there is no applicable aging effect identified that requires management. The applicant also stated that at TMI-1, these Reactor Building penetration components are associated with the Reactor Building but are actually located inside the adjoining Auxiliary Building, Fuel Handling Building and Turbine Building. The applicant further stated that the exterior surface of these penetration closure plates and welds are exposed to the air environments inside each of these adjoining buildings, and the interior surface is exposed to an air environment inside the annulus of the penetration, separated from the Reactor Building environment by a flexible bellows assembly on the end of the penetration inside the Reactor Building. The applicant further stated that the only environments that required evaluation are the air-indoor environment and the air with borated water leakage environment. The applicant again stated that these environments do not have chloride or sulfate levels sufficient to promote stress corrosion cracking, as stated in the LRA. The applicant further stated that the review of applicable operating experience has not identified stress corrosion cracking of any stainless steel components or dissimilar metal welds in an air-indoor environment or an air with borated water leakage environment. The applicant stated that this is also consistent with other NUREG-1801 line items for stainless steel in air-indoor (uncontrolled) environments where no aging effects are identified.

Since no aging effects are identified, the applicant concluded that no aging management program is needed. The staff reviewed the applicant responses, and found them acceptable because they are consistent with the GALL Report for stainless steel in air-indoor (uncontrolled) environments where no aging effects are identified.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Reactor Building (Containment) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.15 Structures and Component Supports – SBO Diesel Generator Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-15

The staff reviewed LRA Table 3.5.2-15, which summarizes the results of AMR evaluations for the SBO diesel generator building component groups.

In LRA Table 3.5.2-15, the applicant identified 39 unique component/material/environment/aging effect/AMP groups for the SBO Diesel Generator Building. Thirty-three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 2, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the SBO Diesel Generator Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.16 Structures and Component Supports – Service Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-16

The staff reviewed LRA Table 3.5.2-16, which summarizes the results of AMR evaluations for the service building component groups.

In LRA Table 3.5.2-16, the applicant identified 32 unique component/material/environment/aging effect/AMP groups for the Service Building. Twenty-seven have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Service Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.17 Structures and Component Supports – Component Supports Commodity Group – Summary of Aging Management Evaluation – LRA Table 3.5.2-17

The staff reviewed LRA Table 3.5.2-17, which summarizes the results of AMR evaluations for the component supports commodity groups.

In LRA Table 3.5.2-17, the applicant identified 89 unique component/material/environment/aging effect/AMP groups for the Component Supports Commodity Group. Sixty-eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate. For two component types, the applicant proposed to manage carbon and low alloy steel material, aging effect loss of material/crevice corrosion, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 8, which states "loss of material due to crevice corrosion is also predicted for this material and environment combination in addition to loss of material due to general and pitting corrosion for the NUREG-1801, Vol. 2 items identified as III.B1.1-13, III.B1.2-10, III.B3-7, III.B4-10, and III.B5-7." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material/crevice corrosion. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage galvanized steel material, aging effect loss of material/general corrosion, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 9, which states "loss of material due to general corrosion is also predicted for this material and environment combination in addition to loss of material due to pitting and crevice corrosion for the NUREG-1801, Vol. 2 items identified as III.B2-7." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material/general corrosion. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed to manage stainless steel (Item 3.5.1-49) material, aging effect loss of material/pitting and crevice corrosion, by using the ASME Section XI, Subsection IWF and Water Chemistry Program. The staff's review of the ASME Section XI, Subsection IWF and Water Chemistry Program are documented in SER Section 3.0.3.2.20 and 3.0.3.2.2 respectively. These line items reference Note I and plant-specific Note 7, which states "general corrosion is not predicted for this material and environment combination." The staff finds that the credited AMPs are appropriate, because the ASME Section XI, Subsection IWF and Water Chemistry Programs require visual inspections on a periodic basis to manage loss of material/pitting and crevice corrosion. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For four component types, the applicant proposed to manage carbon and low alloy steel material (Item 3.5.1-39), aging effect loss of material/general corrosion, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note I and plant-specific Note 6, which states "pitting corrosion is not predicted for this material and environment combination." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material/general corrosion. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed to manage carbon and low alloy steel material (Item 3.5.1-53), aging effect loss of material/general corrosion, by using the ASME Section XI, Subsection IWF. The staff's review of the ASME Section XI, Subsection IWF is documented in SER Section 3.0.3.2.20. These line items reference Note I and plant-specific Note 6, which states "pitting corrosion is not predicted for this material and environment combination." The staff finds that the credited AMP is appropriate, because the ASME Section XI, Subsection IWF Program requires visual inspections on a periodic basis to manage loss of material/general corrosion. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For ten component types, the applicant proposed no aging management program to manage steel material (Item 3.5.1-42 {III.B1.1-12 and III.B1.2-9}), aging effect none. These line items reference Note I and plant-specific Note 2, which states "cumulative fatigue damage is not a TLAA in the TMI-1 CLB." The staff reviewed the GALL Report recommendation for Item III.B1.1-12 and III.B1.2-9 and found an AMP is required only if a CLB fatigue analysis exists. Because cumulative fatigue damage is not a TLAA in the TMI-1 CLB, the staff finds an aging management program for these materials is not required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Component Supports Commodity Group not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.18 Structures and Component Supports – Substation Structures – Summary of Aging Management Evaluation – LRA Table 3.5.2-18

The staff reviewed LRA Table 3.5.2-18, which summarizes the results of AMR evaluations for the substation structures component groups.

In LRA Table 3.5.2-18, the applicant identified 37 unique component/material/environment/aging effect/AMP groups for the Substation Structures. Thirty-two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 2, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate because the Structures Monitoring

Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging none. These line items reference Note I and plant-specific Note 1, which states “the aging effect is not applicable because the environment is not aggressive.” The staff disagrees with the applicant’s AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Substation Structures not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.19 Structures and Component Supports – Turbine Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-19

The staff reviewed LRA Table 3.5.2-19, which summarizes the results of AMR evaluations for the turbine building component groups.

In LRA Table 3.5.2-19, the applicant identified 55 unique component/material/environment/aging effect/AMP groups for the Turbine Building. Forty two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six component types, the applicant proposed to manage reinforced concrete material, aging effect cracking, loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel, by using the Structures Monitoring Program. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note G. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of bond and loss of material (spalling, scaling)/corrosion of embedded steel. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling, scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling, scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For three component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program require visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the Turbine Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.20 Structures and Component Supports – UPS Diesel Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-20

The staff reviewed LRA Table 3.5.2-20, which summarizes the results of AMR evaluations for the UPS diesel building component groups.

In LRA Table 3.5.2-20, the applicant identified 28 unique component/material/environment/aging effect/AMP groups for the UPS Diesel Building. Twenty-three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two component types, the applicant proposed to manage reinforced concrete material, aging effect loss of material (spalling/scaling) and cracking/freeze-thaw, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note H and plant-specific Note 3, which states "the aging effects/mechanisms of exterior below grade concrete in a groundwater/soil environment include loss of material (spalling/scaling) and cracking due to freeze-thaw. These aging effects/mechanisms are managed by the Structures Monitoring Program. The Structures Monitoring Program is appropriate in this situation since loss of material (spalling/scaling) and cracking due to freeze-thaw is still present for exterior below grade concrete above the frost line." The staff finds that the credited AMP is appropriate in each case because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of material (spalling/scaling) and cracking due to freeze-thaw. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For two component types, the applicant proposed no aging management program to manage GALL Item III.A3-5 (reinforced concrete material, item 3.5.1-31), aging effect none. These line items reference Note I and plant-specific Note 1, which states "the aging effect is not applicable because the environment is not aggressive." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds the applicant has enhanced the Structures Monitoring Program (Commitment # 28) to perform groundwater sampling for non-aggressiveness once every five years. Since the applicant has committed to perform groundwater sampling in an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

For one component type, the applicant proposed to manage roofing material, aging effect loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.21. These line items reference Note J. The staff finds that the credited AMP is appropriate, because the Structures Monitoring Program requires visual inspections on a periodic basis to manage loss of weatherproofing integrity due to cracking, organic decomposition, separation, shrinkage, wear, and weathering. Since the applicant has committed to an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for the UPS Diesel Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that, the effects of aging for the structures and component supports within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical Commodity Group

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and I&C components and component groups of the following:

- Insulated Cables and Connections
- Metal Enclosed Bus
- Fuse Holders
- Cable Connections (Metallic Parts)
- Connector Contacts for Electrical Connectors Exposed to Borated Water Leakage
- High Voltage Insulators
- Transmission Conductors and Connections, Switchyard Bus and Connections

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical and instrumentation and control system components and component groups. LRA Table 3.6.1, "Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG 1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for 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 conducted an onsite audit of AMPs to ensure the applicant's claim that certain AMPs were consistent with the GALL Report. The purpose of this audit was to examine the applicant's AMPs and related documentation and to verify the applicant's claim of consistency with the corresponding GALL Report AMPs. The staff did not repeat its review of the matters described in the GALL Report. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. The staff reviewed the AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Section 3.6.2.1 and 3.6.2.2.

The staff also reviewed the AMRs not consistent with or not addressed in the GALL Report. The review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. Details of the staff's evaluation are discussed in SER Section 3.6.2.3.

For components which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

SER Table 3.6-1 below, summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.6 and addressed in the GALL Report.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements (3.6.1-1)	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	Yes	TLAA Environmental Qualification of Electrical Components	Further Evaluation (See Section 3.6.2.2.1)
Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (3.6.1-2)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements	Consistent with GALL Report (See Section 3.6.2.1)
Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (3.6.1-3)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables And Connections Used In Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical Cables And Connections Not Subject to 10 CFR 50.49 EQ Requirements Used In Instrumentation Circuits	Consistent with GALL Report (See Section 3.6.2.1)
Conductor insulation for inaccessible medium voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements (3.6.1-4)	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	No	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	Consistent with GALL Report (See Section 3.6.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Connector contacts for electrical connectors exposed to borated water leakage (3.6.1-5)	Corrosion of connector contact surfaces due to intrusion of borated water	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report
Fuse Holders (Not Part of a Larger Assembly): Fuse holders - metallic clamp (3.6.1-6)	Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders	No	No	Not applicable to TMI-1 (See Section 3.6.2.3)
Metal enclosed bus - bus, connections (3.6.1-7)	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	No	Metal Enclosed Bus	Consistent with GALL Report (See Section 3.6.2.1)
Metal enclosed bus - insulation, insulators (3.6.1-8)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	No	Metal Enclosed Bus	Consistent with GALL Report (See Section 3.6.2.1)
Metal enclosed bus - enclosure assemblies (3.6.1-9)	Loss of Material/ General Corrosion	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report (See Section 3.5.2.1)
Metal enclosed bus - enclosure assemblies (3.6.1-10)	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report (See Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
High voltage insulators (3.6.1-11)	Degradation of insulation quality due to presence of any salt deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	Yes	No	Further Evaluation (See SER Section 3.6.2.2)
Transmission conductors and connections; switchyard bus and connections (3.6.1-12)	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	A plant-specific aging management program is to be evaluated	Yes	No	Further Evaluation (See SER Section 3.6.2.2)
Cable Connections - metallic parts (3.6.1-13)	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	No	Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	Consistent with GALL Report (See Section 3.6.2.1)
Fuse Holders (Not Part of a Larger Assembly) - insulation material (3.6.1-14)	None	None	No	Not applicable	Consistent with GALL Report (See Section 3.6.2.1)

3.6.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.6.2.1 identifies the materials, environments, aging effects requiring management, and the following programs that manage aging effects for the electrical and I&C components:

- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
- Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Metal Enclosed Bus

LRA Table 3.6.2-1, summarizes the AMRs for the electrical and instrumentation and controls components and claims that these AMRs are consistent with the GALL Report.

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

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

The staff audited and 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 verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the electrical and I&C components that are subject to an AMR.

On the basis of its audit and review, the staff finds that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

The staff evaluated the applicant's claim of consistency with the GALL Report and the information pertaining to the applicant proposals for managing aging effects. On the basis of its review, the staff finds that the AMR results 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 for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

LRA Section 3.6.2.2 further evaluates aging management, as recommended by the GALL Report, for the electrical and I&C components and provided information concerning management of the following aging effects:

- Electrical equipment subject to EQ
- Degradation of insulator quality due to presence of any salt deposits and surface contamination, and loss of material due to mechanical wear
- Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues for which the GALL Report recommended further evaluation. 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. The staff noted that applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.8 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

LRA Section 3.6.2.2.2 states that surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the sea coast where salt spray is prevalent. The applicant also stated that the plant is not located near the seacoast and that it is located inland, in central Pennsylvania. The applicant stated that the location is in an area where industrial airborne particle concentrations are comparatively low, since it is not located in a heavy industrial area and that minor contamination is washed away by rainfall or snow, and cumulative buildup has not been experienced and is not expected to occur.

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2, which states that degradation of insulator quality due to salt deposits or surface contamination may occur in high-voltage insulators. The staff noted that the GALL Report recommends further evaluation of plant-specific AMPs for plants at locations of potential salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). The staff also noted that loss of material due to mechanical wear caused by wind on transmission conductors

may occur in high-voltage insulators and that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.
The staff determined that since the plant is not located near facilities that discharge soot or near the sea coast and the applicant's plant specific operating experience did not identify any issues associated with contamination buildup, that degradation of insulators due to salt deposits or surface contamination is not an applicable aging effect requiring management for high-voltage insulators.

LRA Section 3.6.2.2.2 states that wind loading that can cause a transmission line and insulators to sway is considered in the design and installation of transmission lines, and that, although rare, surface rust of the metallic cap may form where galvanizing is burnt off due to flashover from lightening strikes. The applicant also stated that surface rust is not a significant concern and would not cause a loss of intended function if left unmanaged for the period of extended operation. The applicant further stated that it has not identified wear and surface rust during routine substation inspection.

The staff noted that although loss of material of insulators due to mechanical wear is possible, industry operating experience has shown that the transmission conductors do not normally swing significantly and that even when they do swing due to a substantial wind, they do not continue to swing for a very long time after the wind has subsided. The staff also noted that wind loading that can cause a transmission line and insulators to sway is considered during the design and installation of transmission lines and insulators. The staff also noted that surface rust is not an aging effect that can cause a loss of insulation intended function of high-voltage insulators because rust does not have any degradation effect on the surface of insulation.

Furthermore, the staff noted that the applicant's routine inspections have not identified any loss of material of insulators due to mechanical wear. In addition, the staff noted that since the transmission conductors within the scope of license renewal are short spans, the surface area exposed to wind loads are not significant. The staff finds that the loss of material due to wear is not considered an aging effect that will cause a loss of intended functions of the insulators. Based on its review, the staff finds that surface contamination and loss of material due to wear is not an applicable aging effect requiring management to the insulators.

3.6.2.2.3 Loss of Material due to Wind Induced Abrasion and Fatigue; Loss of Conductor Strength due to Corrosion, and Increased Resistance of Connection due to Oxidation or Loss of Pre-load

LRA Section 3.6.2.2.3 addresses loss of material due to wind-induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load. The applicant concluded that loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load are not aging effects requiring management.

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3, which states that loss of material due to wind-induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connections due to oxidation or loss of pre-load may occur in transmission conductors and connections and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

LRA Section 3.6.2.2.3 states that transmission conductor vibration or sway could be caused by wind loading. The applicant also stated that experience has shown that the transmission conductors do not normally swing significantly and that when they do swing due to a substantial wind, they do not continue to swing for very long once the wind has subsided.

The applicant stated that tests performed by Ontario Hydroelectric showed a 30% loss of composite conductor strength of an 80-year-old ACSR (Aluminum Conductor Steel Reinforced). The applicant also stated that the National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength. The applicant stated that the NESC also sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind and temperature and that an example presented in the EPRI Report 1013475, “License Renewal Electrical Handbook,” compares a 4/0 conductor to the results of the Ontario Hydroelectric Study. The applicant further stated that NESC requirements and the handbook guidance were applied to evaluate the in scope transmission conductors.

The applicant also stated that in scope transmission conductors are 795 MCM ACSR and because the transmission conductor design and installation meet the NESC requirements, it considers the Ontario Hydroelectric study to bound its configuration. The applicant further stated that the ultimate strength and NESC heavy load tension requirements of 795 MCM ACSR are 31500 lbs. and 11025 lbs, respectively. The staff noted that the margin between the NESC Heavy Load and the ultimate strength is 20475 lbs which provides a 65% ultimate strength margin. The staff noted that the Ontario Hydroelectric study showed a 30% loss of composite conductor strength in an 80-year-old conductor. The applicant stated that in the case of the 795 MCM ACSR transmission conductors, a 30% loss of ultimate strength would mean that there would still be a 35% ultimate strength margin between what is required by the NESC and the actual conductor strength. The applicant also stated that this illustrates with reasonable assurance that transmission conductors will have ample strength margin through the period of extended operation. The staff noted that the applicant did not address in full detail, the applicability of the Ontario Hydroelectric study. In RAI 3.6-2, dated October 16, 2008, the staff requested that the applicant provide additional information discussing the details of the Ontario Hydroelectric study and how transmission conductors are bounded by the Ontario Hydroelectric tests for 60 years.

In its response to the RAI dated November 12, 2008, the applicant stated that potential conductor degradation is measured by an eddy current sensor that travels along the conductor between transmission towers. The applicant further stated that laboratory tests were performed for fatigue, tensile strength, torsional ductility, and electrical performance and that fatigue tests simulating 50 years of service life were performed to assess existing cables as well as new cables. The applicant also stated that the in scope transmission conductors connect the auxiliary transformers to the switchyard and that the transmission conductors are 795 MCM 26/7 ACSR. The staff noted that this is the same type of transmission conductors evaluated in the Ontario Hydroelectric study. The applicant also stated that the 795 MCM 26/7 ACSR transmission conductor is approximately 1 inch in diameter and is configured with 7 steel conductors wrapped by 26 aluminum conductor versus the 4/0 6/1 ACSR conductor which is approximately ½ inch in diameter with a single steel conductor wrapped by six aluminum conductors. The rated or ultimate strength per ASTM standards for the 795 26/7 ACSR conductor is 31,500 lbs while the rated strength for the 4/0 6/1 ACSR conductor is 8,350 lbs. Therefore, the applicant concluded that the physical construction of the in scope transmission conductors’ strength margin is bounded by the handbook analysis of the 4/0 ACSR conductor and is also bounded by the Ontario Hydroelectric study.

Based on its review, the staff finds the applicant's response to RAI 3.6-2 acceptable. The staff confirmed that the applicant's transmission conductors are bounded by those in the Ontario Hydroelectric study which used a sample of 336.4 MCM 30/7 ACSR conductors. The staff noted that this study showed a 30% loss of composite conductor strength in an 80-year-old conductor and that the ratio between the heavy loading and the ultimate conductor strength of a 80 year old transmission conductor (after losing 30% of conductor strength due to corrosion) is 50% (11025 lbs / (31500 x 70% lbs). The staff noted that the NESC requires that the maximum tension of installed conductors be not more than 60% of the rated breaking strength under NESC design conditions and that the ratio of maximum heavy load and the ultimate conductor strength of installed conductors are below the 60% NESC requirements. Furthermore, the staff noted that the length of transmission conductors in scope of license renewal is generally short span and that the transmission conductors connecting the switchyard to the startup transformer provide restoration of offsite power after a SBO event. The staff also noted that the loading of these transmission conductors is much less than the calculated heavy loading of a long span transmission line. Based on this information, the staff determined that loss of conductor strength due to corrosion of transmission conductor is not a significant aging effect requiring management for the period of extended operation. The staff finds that with a 30% loss of conductor strength, there is still ample margin between the NESC requirements and the actual conductor strength. The staff's concern described in RAI 3.6-2 is resolved.

LRA Section 3.6.2.2.3 states that bolted connections associated with the transmission conductors employ the use of good bolting practices consistent with the recommendations of EPRI 1003471, "Electrical Connector Application Guideline." The applicant also stated that bolting connections are treated with corrosion inhibitors to avoid connection oxidation and torque to avoid loss of pre-load, at the time of installation. The staff noted that in EPRI TR-104213, "Bolted Joint Maintenance & Application Guide," EPRI identified a special problem with Belleville washers. Specifically, EPRI identified hydrogen embrittlement as a recurring problem with Belleville washers and other springs because when the springs are electroplated, the plating process forces hydrogen into the metal grain boundaries and if the hydrogen is not removed, the spring may spontaneously fail at any time while in service. In RAI 3.6-3, dated October 16, 2008, the staff requested that the applicant provide additional information to describe the types of finishes the Belleville washers currently have and current activities used to confirm the effectiveness of switchyard bolted connections.

In its response to the RAI dated November 12, 2008, the applicant stated that electroplated Belleville washers are not in use in the switchyard connections. The applicant also stated that there are no aging effects for transmission conductor connections and switchyard bus connections that require an AMP. The applicant further stated that even though there are no aging effects requiring management, the switchyard connections are currently surveyed as part of preventive maintenance, via thermography, at a minimum of every six months in accordance with procedures and best preventive maintenance practices.

Based on its review, the staff finds the response to RAI 3.6-3 acceptable because electroplated Belleville washers are not used and hydrogen embrittlement is not an issue. The staff also finds that the applicant's current use of thermography to confirm the effectiveness of switchyard bolted connections to be acceptable because the use of anti-oxidant compounds will prevent the formation of oxides on metal surfaces and prevent moisture entering the connections, thus reducing the chances of corrosion that could increase resistance. The staff finds that increased resistance of connections due to oxidation or loss of pre-load are not aging effects requiring management. The staff's concern described in RAI 3.6-3 is resolved.

Based on its review, the staff finds that loss of material caused by transmission conductor vibration or sway and loss of conductor strength are not applicable aging effects requiring management. The staff also finds that the design of transmission connections using Bellville washers will eliminate the potential torque relaxation of bolted connections.

Based on a review of the programs identified above, including the applicant's response to RAIs 3.6-2 and 3.6-3, the staff concludes that the applicant's programs meet 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 determines that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's QA program.

3.6.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Table 3.6.2-1, the staff reviewed additional details of AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

LRA Table 3.6.2-1 states that, via Notes F through J, 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 concerning how the aging effects will be managed. 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 had demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following section.

LRA Section 3.6.2.3.1 states that in-scope fuse holders, that are not part of a larger assembly, are located in three enclosed electrical boxes that contain only fuses and terminal blocks. The LRA also stated that two of the boxes contain fuses for the reactor protection system (RPS) nuclear instrumentation circuits. The applicant also stated that the fuse distribution panels VBA-1 and VBB-1 contain the fuses for the RPS nuclear instrumentation circuits and are located in the "A" and "B" Inverter Room, respectively, on elevation 322 feet of the control building and that the third box contains fuses for wireless telephone and radio equipment circuits. The applicant also stated that terminal box T1186 contains the fuses for wireless telephones and radio equipment and that it is located in the operations radio room on elevation of 322 feet of the turbine building. The applicant also stated that other fuse holders that are not part of a larger assembly are for circuits that do not perform a license renewal intended function.

The applicant stated that aging effects as discussed in the GALL Report are not applicable to the fuse holders in these three in scope electrical boxes. Regarding the moisture aging effect, the applicant stated that the fuse holders are located in three closed, metallic, electrical boxes that are protected from moisture by two barriers and that the first barrier is their indoor location in the control building and turbine building and that these locations do not see high relative humidity during normal conditions. The applicant also stated that the second barrier that protects the fuse holders from exposure to moisture is their location inside closed electrical boxes. Regarding the chemical aging effect, the applicant stated that the fuse holders are protected from chemical contamination by their location within closed electrical boxes and that there are no sources of chemicals in the vicinity of the electrical boxes. The applicant stated that oxidation and corrosion are not a concern since the fuse holders are not located in or near humid areas nor are they exposed to industrial or oceanic environments.

The applicant also stated that a walk down of these three electrical boxes containing the in scope fuse holders confirmed that the operating conditions for these fuse holders are clean and dry with no evidence of moisture intrusion, chemical contamination, oxidation, or corrosion. For fatigue, mechanical stress, and manipulation aging effects, the applicant stated that instrumentation and control circuits operate at low currents where no appreciable thermal cycling or ohmic heating occurs and that these fuse holders are for nuclear instrumentation and communication circuits that are lightly loaded. The applicant stated that electrical and thermal cycling is not an applicable aging mechanism for these fuse holders.

For mechanical stress due to forces associated with electrical faults and transients, the applicant stated that these stresses are mitigated by the fast action of circuit protective devices at high currents and that mechanical stress due to electrical faults is not considered a credible aging mechanism since such faults are infrequent and random in nature. For wear and fatigue, the applicant stated that the fuse holders are not subjected to frequent manipulation, (i.e., removal and reinsertion), because they are neither clearance nor isolation points that support periodic testing or preventive maintenance. Regarding the vibration aging effect, the applicant stated that the fuse holders are located in electrical boxes that are mounted to plant walls and are not mounted on moving or rotating equipment such as compressors, fans or pumps. The applicant further stated that because the electrical boxes are mounted on plant walls with no attached sources of vibration, vibration is not an applicable aging mechanism.

The staff reviewed issue report 00461358 that describes an incident where the root cause was found to be linked to a corroded fuse holder (inside an active assembly). As a result, the applicant took proper corrective action as described in work order C2012359. In RAI 3.6-1, dated October 16, 2008, the staff requested that the applicant provide additional information to explain why the potential corrosion of fuse holders inside the metallic electrical boxes due to condensation and an aging effect requiring management for those fuse holders is not applicable.

In its response to the RAI, dated November 12, 2008, the applicant stated that the final Apparent Cause Evaluation (ACE) for issue report 00461358 determined that the control circuit failure was the result of distortion of the removable fuse clips and not corrosion. The applicant further stated that this ACE includes laboratory analysis on a sampling of fuse/fuse block assemblies, which included the trip and close fuses/fuse block assemblies that were the initiators of the failure. The applicant also stated that the green material found on the fuse holder stabs, which can be an indication of corrosion, was determined to be electrical grease and that there was no evidence of corrosion products.

Based on its review, the staff finds the applicant’s response to RAI 3.6-1 acceptable because the evaluation results showed that corrosion of fuse holders was not the initiator of the fuse failure. The staff’s concern described in RAI 3.6-1 is resolved.

Based on its review, the staff finds that ohmic heating, thermal cycling, electrical transients, vibration, chemical contamination, fatigue, corrosion and oxidation are not applicable aging mechanisms/effects requiring management for the metallic clamps of the fuse holders within the scope of license renewal. The staff also finds that the applicant has appropriately evaluated AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the aging effects 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).

3.6.3 Conclusion

The staff concludes that the applicant has demonstrated that the aging effects associated with the electrical and I&C systems 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).

The staff also reviewed the applicable UFSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing the aging effects of the electrical and I&C systems, as required by 10 CFR 54.21(d).

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.7 Conclusion for Aging Management Review Results

The staff reviewed the information in LRA Section 3, “Aging Management Review Results,” and Appendix B, “Aging Management Programs.” On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended 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 applicable UFSAR Supplement program summaries and concludes that the UFSAR Supplement adequately describes the AMPs credited for managing aging as required by 10 CFR 54.21(d).

With regard to these matters, the staff concludes that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and any changes made to the CLB, in order to comply with 10 CFR 54.21(a)(3), are in accordance with the NRC’s regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This section of the safety evaluation report (SER) addresses the identification of time-limited aging analyses (TLAAs). In Sections 4.2 through 4.8 of the license renewal application (LRA), AmerGen Energy Company, LLC (AmerGen or the applicant) addressed the TLAAs for Three Mile Island Nuclear Station, Unit 1, (TMI-1). SER Sections 4.2 through 4.8 document the review of the TLAAs conducted by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff).

TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. Pursuant to Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), applicants must list TLAAs as defined in 10 CFR 54.3, “Definitions.”

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list existing plant-specific exemptions granted under 10 CFR 50.12, “Specific Exemptions,” based on TLAAs. For any such exemptions, the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations for TMI-1 against the six criteria specified in 10 CFR 54.3. The applicant indicated that it has identified the calculations that met the six criteria by searching the current licensing basis (CLB). The CLB includes the updated final safety analysis report (UFSAR), engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable vendor reports. In LRA Table 4.1-1, “Time Limited Aging Analysis Applicable to Three Mile Island Unit 1,” the applicant listed the following applicable TLAAs:

- Neutron Embrittlement of the Reactor Vessel and Internals
- Metal Fatigue of Piping and Components
- Leak-Before-Break Analysis of Primary System Piping
- Fuel Transfer Tube Bellows Design Cycles
- Crane Load Cycle Limits
- Loss of Prestress in Concrete Containment Tendons
- Environmental Qualification of Electrical Equipment

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it had identified two exemptions granted under 10 CFR 50.12 that were based on a TLAA, as defined in 10 CFR 54.3.
The first exemption concerns the end-of-license neutron fluence. This exemption request was submitted by the applicant on March 29, 2001 and requested an exemption from the requirements of 10 CFR 50, Appendix G and 10 CFR 50, Section 50.61(a)(5), in order to

address provisions of amendments to the Technical Specification Pressure – Temperature Limit Curves. The exemption would allow the use of American Society of Mechanical Engineers (ASME) Code Cases and an alternative approach as follows:

- Code Case N-588, which permits the use of circumferentially oriented flaws in circumferential welds for development of Pressure-Temperature (P-T) limits
- Code Case N-640, which permits application of the lower bound static initiation fracture toughness value equation as the basis for establishing the P-T curves in lieu of using the lower bound crack arrest fracture toughness value equation
- The master curve approach for determining the initial reference temperature for weld metal WF-70 in the TMI-1 reactor vessel.

The above exemption does not need to be continued for the period of extended operation because the 29 EFPY P-T limit curves for which the exemption was granted will not be used during the period of extended operation.

The second exemption concerns 10 CFR 50 Appendix A, General Design Criterion 4. This exemption request concerned the requirement to assume a break equivalent to the double-ended rupture of the largest pipe in the reactor coolant system.

The LRA states that the Leak-Before-Break (LBB) evaluation includes a fatigue flaw growth analysis based upon thermal cycles associated with 40 years of plant operation. The applicant further stated that the evaluation addresses thermal aging of reactor coolant pump (RCP) casings for the current license period and that both TLAAs are evaluated for the period of extended operation which includes the basis for continuing this exemption for the period of extended operation.

4.1.2 Staff Evaluation

LRA Table 4.1-1 lists the TLAAs the applicant identified as being applicable to TMI-1. The staff reviewed the information to determine whether the applicant had provided sufficient information pursuant to 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs meet the following six criteria:

(1) involve systems, structures, and components within the scope of license renewal, pursuant to 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (for example, 40 years)

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, pursuant to 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

The applicant provided a list of potential TLAAs from NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP-LR) dated September 2005. The applicant listed those potential TLAAs applicable to TMI-1 in LRA Table 4.1-2, "Review of Analyses Listed in NUREG-1800, Tables 4.1-2 and 4.1-3." The applicant further provided a list of examples of plant-specific TLAAs from the SRP-LR in LRA Table 4.1-3.

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted in accordance with 10 CFR 50.12, based on TLAAs, and evaluated and justified for continuation through the period of extended operation. The LRA states that each active exemption was reviewed to determine whether it was based on a TLAA. The applicant identifies two TLAA-based exemptions. Based on the information provided by the applicant regarding the results of the applicant's search of the CLB to identify these exemptions, the staff has determined, in accordance with 10 CFR 54.21(c)(2), that there is one TLAA-based exemption which has been justified for continuation through the period of extended operation.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1), and that one exemption has been granted on the basis of a TLAA for which continuation has been justified during the period of extended operation as specified in 10 CFR 54.21(c)(2).

4.2 Neutron Embrittlement of the Reactor Vessel and Internals

The regulations that govern reactor vessel integrity are in 10 CFR Part 50:

- Section 50.60 of 10 CFR requires all light-water reactors to meet 10 CFR Part 50 Appendices G and H regarding fracture toughness, pressure-temperature (P-T) limits, and material surveillance program requirements for the reactor coolant boundary
- Section 50.61 of 10 CFR provides fracture toughness requirements for protection against pressurized thermal shock

Neutron embrittlement describes changes in mechanical properties of reactor vessel (RV) materials in the vicinity of the reactor core beltline region, i.e., the region defined by the upper and lower active core planes. The metric of neutron exposure is fluence, i.e., the time integral of neutron flux with energies greater than 1.0 MeV. The most pronounced material change, relevant to this case, is reduction in fracture toughness with increasing fluence. As fracture toughness decreases with cumulative fast neutron exposure, the material's resistance to crack propagation decreases. Fracture toughness of ferritic materials depends upon temperature. The reference temperature for nil-ductility transition, RT_{NDT}, is the transition temperature above which the material is ductile, and below which it is brittle. As neutron fluence increases, the RT_{NDT} increases and higher temperatures are required for the material to remain ductile. This shift in reference temperature is denoted as adjusted reference temperature (ART) and is equal to the sum RT_{NDT} + ΔRT_{NDT} + a margin term where ΔRT_{NDT} is the difference induced by the fluence exposure. Determination of the projected RV reduction in fracture toughness as a function of neutron fluence affects several analyses that support TMI-1 operations:

- RV Adjusted Reference-Temperature
- RV Material Upper-Shelf Energy (USE)
- RV Pressurized Thermal Shock (PTS)
- Pressure-Temperature Limits (P-T Limits)

As extension of the operating period from 40-years to 60-years will increase neutron fluence, the 60-year fluence value and its impact upon the analyses that support operation must be determined.

4.2.1 Neutron Fluence Analysis

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 discusses a fluence calculation that is based on a 100-% capacity factor for the period of extended operation. This fluence calculation predicts fast neutron exposure for the reactor vessel for 52 effective full power years (EFPY). The LRA states that the reactor vessel is expected to accrue 49.6 EFPY at the end of the 60-year operating life.
In the LRA, the applicant stated that the fluence calculation supporting the 60-year operating life included a benchmark comparison to measured cavity dosimetry test results, and that the projections were determined to meet the uncertainty requirements of Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence."

The LRA also stated that the fluence calculation was performed using an NRC-approved methodology.

In summary, the applicant provided the following information concerning the reactor vessel fluence projection that is significant to the NRC staff's evaluation:

- The applicant has projected reactor vessel fluence to the end of the renewed 60-year operating life

- The fluence projections account for 52 EFPY of exposure, and the end-of-life exposure is, based on a 100-% capacity factor, predicted to be 49.6 EFPY

- The fluence projections were benchmarked using plant specific cavity dosimetry

- The fluence projections were calculated using an NRC-approved methodology that has been found to adhere to the guidance of RG 1.190, Revision 2 [*sic*]

4.2.1.2 Staff Evaluation

The applicant identified reactor vessel neutron embrittlement as a TLAA. The neutron embrittlement analyses are supported by a fluence calculation, which was submitted to the NRC in a letter dated September 10, 2008. LRA Section 4.2.1 discusses the calculations, and the applicant states that the calculations are performed to be consistent with the guidance contained in RG 1.190.

The NRC staff evaluated the fluence determination to establish that it adheres to the guidance contained in RG 1.190. In consideration of this guidance and the regulations set forth in 10 CFR 54, this evaluation establishes that (1) the licensee's fluence determination methods employed in the analysis of surveillance capsule "T" follow the guidance presented in RG 1.190, and (2) that the fluence determination accounts for the period of extended operation, consistent with 10 CFR 54.21(c)(1)(i).

RG 1.190 describes methods and assumptions acceptable to the NRC staff for determining the pressure vessel neutron fluence with respect to the general design criteria (GDC) contained in Appendix A to 10 CFR 50. By considering the applicable GDC, the NRC staff establishes that the neutron fluence calculation adequately supports the reactor vessel neutron embrittlement analyses, such that compliance with 10 CFR 54.21(c)(1) can be determined. In this case, the evaluation establishes that the applicant's neutron fluence calculations, which provide input to the neutron embrittlement-related TLAA, have been projected for the period of extended operation, thus demonstrating compliance with 10 CFR 54.21(c)(1)(ii) as it pertains to the reactor vessel fluence calculation.

In consideration of the guidance set forth in RG 1.190, GDC 14, 30, and 31 are applicable. GDC 14, "Reactor Coolant Pressure Boundary," requires the design, fabrication, erection, and testing of the reactor coolant pressure boundary so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. GDC 30, "Quality of Reactor Coolant Pressure Boundary," requires, among other things, that components comprising the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical. GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," pertains to the design of the reactor coolant pressure boundary, stating:

> The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions, (1) the boundary behaves in a non-brittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating maintenance, testing and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient stresses, and (4) size of flaws.

The NRC staff evaluated the applicant's fluence projections to determine if the projections adequately account for the period of extended operation. Based on a 100-% capacity factor, the applicant predicts that the period of extended operation will result in 49.6 EFPY of exposure. In actuality, the applicant's fluence projections extend to 52 EFPY. The NRC staff accepts these projections because they are conservative with respect to the predicted peak, end-of-life exposure for the following two reasons: (1) the 100-% capacity factor is conservative in that the reactor will not accrue such exposure, because the reactor must incur outage time for refueling and other operational issues, which will reduce the actual capacity factor relative to the 100-% assumption; and (2) the 52 EFPY fluence projection bounds the 49.6 EFPY projected, end-of-life exposure. For these two reasons, the NRC staff finds that the 52 EFPY fluence projection adequately accounts for the neutron exposure during the period of extended operation.

The NRC staff evaluated the applicant's fluence calculations to determine if the projections were made using an approved methodology that adheres to the guidance contained in RG 1.190. The LRA states that the fluence calculation methodology adheres to the guidance contained in RG 1.190, Revision 2. The staff noted that Revision 2 to RG 1.190 does not exist. In part 2 of RAI 4.2.0.0-01, dated August 20, 2008, the staff requested that the applicant provide additional information to clarify the correct edition of RG 1.190 that was used.

In its response to part 2 of the RAI dated September 10, 2008, the applicant stated that the reference to Revision 2 is an error, and that the fluence calculation adheres to the guidance contained in the RG 1.190 dated March 2001.

Based on its review, the staff finds that applicant's response to part 2 of RAI 4.2.0.0-01 acceptable because the applicant has correctly identified the applicable regulatory guidance for neutron fluence calculations. The staff's concern described in part 2 of RAI 4.2.0.0-01 is resolved.

To reach its determination regarding the adherence of the applicant's fluence calculation to RG 1.190 the staff determined that additional information was needed. In part 1 of RAI 4.2.0.0-01, dated August 20, 2008, the staff requested that the applicant provide additional information regarding the referenced fluence calculation.

In its response to part 1 of the RAI dated September 20, 2008, the applicant provided the additional information requested by the staff. The staff reviewed the information submitted to determine the following with regard to RG 1.190:

(1) Whether the fluence calculations were performed using an NRC-approved methodology

(2) Whether the methodology adheres to the guidance contained in regulatory position 1 as set forth in RG 1.190

(3) Whether the fluence benchmarking adheres to the guidance contained in regulatory positions 2 and 3 as set forth in RG 1.190.

The applicant stated that the calculation describing the fluence analysis was performed using the methodology described in BAW-2241NP-A, which was previously reviewed and approved by the NRC.

BAW-2241NP-A, Revision 2, "Fluence and Uncertainty Methodologies," was approved by the staff as described in a safety evaluation issued to Areva NP on April 28, 2006. While this revision expanded the applicability of the fluence calculation methodology to additional types of reactors, the original approval determined the applicability of the methodology to Babcock and Wilcox reactors such as TMI-1. The staff's original and subsequent approvals are documented in BAW-2241NP-A, Revision 2. Therefore, the NRC staff concludes that the licensee's fluence calculation methodology has been approved by the NRC.

The staff's approval of BAW-2241NP-A, Revision 2, describes the method's adherence to the guidance set forth in RG 1.190 (Items 2 and 3 of the list above), and the acceptability of the code benchmarking to vessel configurations similar to TMI-1. Hence, the methodology and its benchmarking have been found to adhere to the guidance in RG 1.190. On this basis, the licensee's fluence calculation methodology used in support of the requested license renewal is acceptable.

In addition to the generic methodology benchmarking described in BAW-2241NP-A, in a letter dated September 10, 2008, the applicant provided the results of specific benchmarking based on cavity dosimetry. The average calculated-to-measured ratio of the cavity dosimetry was 1.04, with a standard deviation of 0.07. This is within the ±20% benchmark uncertainty recommended by RG1.190, and is acceptable to the staff.

Based on its review, the staff finds the applicant's response to part 1 of RAI 4.2.0.0-01 acceptable because the applicant's fluence calculation methodology and its benchmarking adhere to the guidance in RG 1.190. The staff's concern described in part 1 of RAI 4.2.0.0-01 is resolved.

4.2.1.3 UFSAR Supplement

The applicant provided an UFSAR Supplement summary description of its TLAA evaluation of neutron fluence analysis in LRA Section A.4.2.1. On the basis of its review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address neutron fluence is adequate.

4.2.1.4 Conclusion

The applicant has provided fluence calculations performed using an acceptable methodology, supported by analytic uncertainty analysis and comparison to approved test facilities and benchmarked using plant-specific cavity dosimetry. The methodology and benchmarking are found to be adherent to the guidance contained in RG 1.190, and hence acceptable to the NRC staff.

Additionally, the NRC staff finds that the applicant's fluence projection extends to 52 EFPY, which conservatively bounds the period of extended operation, based on a 100-% capacity factor. As discussed above, the use of a 52 EFPY end-of-life exposure is acceptable because the 100-% capacity factor assumption on which it is based is conservative.

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for reactor vessel neutron fluence, the analyses 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).

4.2.2 Charpy Upper-Shelf Energy for Beltline Plates and Forgings

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 summarizes the evaluation of the upper-shelf energy (USE) analysis for the TMI-1 plates and forgings for the period of extended operation. Fracture toughness is a measure of a material's resistance to crack propagation. Charpy V-notch tests indirectly estimate fracture toughness, and Charpy V-notch test results are measured in ft.-lbs. of absorbed energy. The more ductile a material, the higher the fracture toughness and the more ft.-lbs. of energy will be absorbed during the Charpy V-notch test. The fracture toughness of RV steels is temperature-dependent. At low temperatures, the vessel material toughness is relatively low and constant and the material behaves in a brittle fashion. Rising temperatures reach a point where the toughness increases rapidly until another plateau where the toughness is relatively high and constant. In this high toughness region, the material is ductile. These regions of the curve are the lower shelf, transition zone, and upper shelf, respectively. Title 10 of the *Code of Federal Regulations* (CFR) Part 50, Appendix G contains screening criteria that limit the degree that the USE value for a RV material may be allowed to drop due to neutron radiation exposure. The regulation requires the initial RV material USE to be equal to or above 75 ft.-lb. and for the USE to be equal to or above 50 ft.-lb. throughout the licensed life of the vessel, unless lower values of USE can be demonstrated to provide margins of safety against fracture equivalent to those required by the Appendix G of the American Society of Mechanical Engineers (ASME) Code, Section XI.

An analysis of the USE of the TMI-1's RV beltline plate and forging materials for the license renewal period [52 effective full power years (EFPY)] requires the use of Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials." The RV USE analyses were at the 1/4T wall location of each beltline material using the respective copper contents, projected fluences, and Position 1.2 of the RG 1.99, Revision 2. From the RV USE analyses of the TMI-1 plates and forgings, the lowest predicted USE (64 ft.-lbs.) at 52 EFPY is that for lower shell plate C3251-1.

4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.2.2 to verify pursuant to 10 CFR 54.21(c)(1)(ii) that the analysis has been projected to the end of the period of extended operation.

Section IV.A.1 to 10 CFR Part 50, Appendix G provides the Commission's requirements for demonstrating that RVs in U.S. light-water reactor facilities will have adequate protection from brittle failure throughout their service lives. The rule requires RV beltline materials to have USE values equal to or above 75 ft-lb when the materials are in the unirradiated condition and equal to or above 50 ft-lb throughout the licensed life of the RV. RG 1.99, Revision 2 provides an expanded discussion regarding the calculations of USE values and describes two methods for determining USE values for RV beltline materials, depending on whether or not a given RV beltline material is represented in the plant's Reactor Vessel Material Surveillance Program.

The applicant provided its USE analyses for the RV beltline plate and forging materials of TMI-1 in Table 4.2.2-1 of the LRA. The USE analyses were based on the 1/4T neutron fluence values listed in LRA Table 4.2.2-1 and these neutron fluence values were based on the projected values at the end of the extended period of operation (i.e., at 52 EFPY). The staff performed independent calculations of the USE values for the RV beltline plate and forging materials through the expiration of the extended period of operation. The staff applied the methods provided in RG 1.99, Revision 2 for performing the independent USE calculations. The staff determined that for the TMI-1 plates and forgings, lower shell plate C3251-1 is the limiting material. The staff calculated a USE value of 64 ft-lb for the TMI-1 lower shell plate at 52 EFPY and this value is in agreement with the value calculated by the applicant for this plate. This value meets the acceptance criterion in 10 CFR Part 50, Appendix G for maintaining the USE values of the RV beltline materials above 50 ft-lbs throughout the licensed life of the plant. Therefore, since the bounding plate and forging material for the TMI-1 RV meets the requirements of 10 CFR Part 50, Appendix G, all of the TMI-1 RV beltline plate and forging materials meet the regulatory requirements.

4.2.2.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of Charpy USE for beltline plates and forgings in LRA Section A.4.2.2. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant's actions to address Charpy USE for beltline plates and forgings is adequate.

4.2.2.4 Conclusion

Based on the technical assessments stated above, the staff determined that the RV plate and forging materials at TMI-1 will maintain an acceptable level of USE values throughout the expiration of the extended period of operation. The staff concludes that the applicant's TLAA for USE for TMI-1 RV plate and forging materials, as given in Section 4.2.2 of the LRA, is in compliance with requirements of 10 CFR Part 50, Appendix G and, therefore, is acceptable.

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analysis for TMI-1 RV plate and forging materials has been projected to the end of the period of extended operation.

4.2.3 Charpy Upper-Shelf Energy for Beltline Welds (Equivalent Margins Analysis)

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3 summarizes the evaluation of the upper shelf energy (USE) analysis for the TMI-1 beltline welds for the period of extended operation. Fracture toughness is a measure of a material's resistance to crack propagation. Charpy V-notch tests indirectly estimate fracture toughness, and Charpy V-notch test results are measured in ft.-lbs. of absorbed energy. The more ductile a material, the higher the fracture toughness and the more ft.-lbs. of energy will be absorbed during the Charpy V-notch test. The fracture toughness of RV steels is temperature-dependent. At low temperatures, the vessel material toughness is relatively low and constant and the material behaves in a brittle fashion. Rising temperatures reach a point where the toughness increases rapidly until another plateau where the toughness is relatively high and constant. In this high toughness region, the material is ductile. These regions of the curve are the lower shelf, transition zone, and upper shelf, respectively. Title 10 of the *Code of Federal Regulations* (CFR) Part 50, Appendix G contains screening criteria that limit the degree that the USE value for a RV material may be allowed to drop due to neutron radiation exposure. The regulation requires the initial RV material USE to be equal to or above 75 ft.-lb. and for the USE to be equal to or above 50 ft.-lb. throughout the licensed life of the vessel, unless lower values of USE can be demonstrated to provide margins of safety against fracture equivalent to those required by the Appendix G of the American Society of Mechanical Engineers (ASME) Code, Section XI. The 40-year Charpy USE values for all Linde 80 beltline welds are less than 50 ft.-lbs, therefore, in accordance with the requirements of 10 CFR Part 50, Appendix G, an equivalent margins analysis using projected 40-year fluence values was required. This equivalent margins analysis identified welds WF-25 and SA-1526 as limiting welds. An equivalent margins analysis for 48 EFPY had previously been reported in AREVA Generic License Renewal Technical Report BAW-2251A, Appendix B (BAW-2275), which was approved by the NRC. The analysis was updated from 48 EFPY to 52 EFPY to determine the associated fracture toughness properties for the TMI-1 limiting welds after 60-years of operation.

The updated equivalent margins analysis considered the effect of the increased fluence on the material J-integral resistance, J_R, a material property that is a function of fluence and copper content. The equivalent margins acceptance criterion from Appendix K of the ASME Code for J at Level A and B service loadings is based on a ductile flaw extension of 0.10 inch and is satisfied when $J_1 < J_{0.1}$ (where $J_{0.1}$ equals the material J-integral resistance (J_R) that will result in a ductile flaw extension of 0.1 inch and J_1 equals the applied J-integral with a safety factor of 1.15 on pressure and a safety factor of 1.0 on thermal loading). For the limiting circumferential weld WF-25, the material J-integral resistance is reduced from 543 in-lb/in^2 to 528 in-lb/in^2 due to the increase in ¼ T fluence from 48 EFPY (7.00 x 10^{18} n/cm^2, E > 1 MeV) to 52 EFPY (1.119 x 10^{19} n/cm^2, E > 1 MeV). The J_1 value for weld WF-25 remains 170 in-lb/in^2, therefore the $J_{0.1}/J_1$ ratio changes from 3.20 to 3.11. For the limiting axial weld SA-1526, J_R is reduced from 545 in-lb/in^2 to 543 in-lb/in^2 due to the increase in ¼ T fluence from 48 EFPY (6.55 x 10^{18} n/cm^2, E > 1 MeV) to 52 EFPY (6.884 x 10^{19} n/cm^2, E > 1 MeV). The J_1 value for weld WF-25 remains 502 in-lb/in^2, therefore the $J_{0.1}/J_1$ ratio changes from 1.09 to 1.08. For C and D service loads, the limiting weld is SA-1526. The 52 EFPY fluence at the T/10 location is 0.961 x 10^{19} n/cm^2. This is approximately equal to the fluence evaluated in BAW-2275, 0.955 x 10^{19} n/cm^2. The values of J_R and $J_{applied}$ in BAW-2275 are 545 and 241, respectively, yielding a margin of 2.26. Since the updated fluence for SA-1526 at the T/10 location is essentially unchanged, J_R is not affected and the margin of J_R to $J_{applied}$ will be approximately 2.26, which is well above the acceptance criterion of 1.0. Therefore, for 52 EFPY, the conclusions reported in BAW-2275 remain valid regarding the evaluation of Level C service loads relative to J_R and $J_{applied}$ and to Level C and D service loads relative to ductile and stable flaw extension. The analysis and conclusions demonstrate that welds WF-25 and SA-1526 satisfy the acceptance criteria of the ASME Code, Section XI, Appendix K, and therefore provide margins of safety against fracture equivalent to those required by Appendix G of Section XI to the ASME Code. Therefore, welds WF-25 and SA-1526 have adequate upper-shelf toughness and satisfy the requirements of Appendix G to 10 CFR Part 50, Section IV.A.1.a at the reactor vessel life of 52 EFPY (60 years).

4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.2.3 to verify pursuant to 10 CFR 54.21(c)(1)(ii) that the analysis has been projected to the end of the period of extended operation.

Section IV.A.1 to 10 CFR Part 50, Appendix G provides the Commission's requirements for demonstrating that RVs in U.S. light-water reactor facilities will have adequate protection from brittle failure throughout their service lives. The rule requires RV beltline materials to have USE values equal to or above 75 ft-lb when the materials are in the unirradiated condition and equal to or above 50 ft-lb throughout the licensed life of the RV, "unless it is demonstrated in a manner approved by the Director, Office of Nuclear Reactor Regulation, that lower values of Charpy upper-shelf energy will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code." Topical Report BAW-2275, addressed the issue of low-upper-shelf fracture toughness for Linde 80 welds in Babcock & Wilcox (B&W) vessels, for an extended license period of 48 EFPY. NRC staff reviewed BAW-2275 using the calculational procedures and evaluation criteria of Appendix K of the ASME Code, and approved the report (ADAMS ML0036702807). NRC staff concluded that the TMI-1 Linde 80 welds satisfy the acceptance criteria of Appendix K of Section XI of the ASME Code, hence the TMI-1 Linde 80 welds have margins equivalent to those of Appendix G of Section XI of the ASME Code.

Staff reviewed effect of the increased fluence values, from 48 EFPY to 52 EFPY, on the material J-integral resistance, J_R. The material property, J_R, is a function of fluence and copper content. Copper contents of the TMI-1 limiting materials did not change from BAW-2275. The staff confirmed that welds WF-25 and SA-1526 satisfy the requirement of $J_1 < J_{0.1}$ for Level A and B service loadings (with respective values for J_1 and $J_{0.1}$ of 170 in-lb/in^2 and 543 in-lb/in^2 at 48 EFPY and 170 in-lb/in^2 and 528 in-lb/in^2 at 52 EFPY for WF-25; and respective values for J_1 and $J_{0.1}$ of 502 in-lb/in^2 and 545 in-lb/in^2 at 48 EFPY and 502 in-lb/in^2 and 543 in-lb/in^2 at 52 EFPY for SA-1526). The staff confirmed that all $J_{0.1}/J_1$ ratios remain greater than 1. For Level C and D service loads, the staff agreed that the 52 EFPY fluence at the T/10 location is essentially equivalent to the 48 EFPY fluence at the T/10 location evaluated in BAW-2275. Therefore, the margin of J_R to $J_{applied}$ remains at 2.26, well above the acceptance criteria of 1.0.

4.2.3.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of Charpy USE for beltline welds in LRA Section A.4.2.3. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant's actions to address Charpy USE for beltline welds is adequate.

4.2.3.4 Conclusion

Based on the technical assessments stated above, the staff determined that the RV weld materials at TMI-1 satisfy the acceptance criteria of Appendix K of Section XI of the ASME Code, and therefore have margins equivalent to those of Appendix G of Section XI of the ASME Code as required by 10 CFR Part 50, Appendix G. The staff concludes that the applicant's TLAA for USE for TMI-1 RV weld materials, as given in Section 4.2.3 of the LRA is in compliance with requirements of 10 CFR Part 50, Appendix G and, therefore, is acceptable.

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analysis for TMI-1 RV weld materials has been projected to the end of the period of extended operation.

4.2.4 Pressurized Thermal Shock Limits (RTPTS) for Reactor Vessel Materials Due to Neutron Embrittlement

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 summarizes the evaluation of the unit's pressurized thermal shock (PTS) analysis for the period of extended operation. 10 CFR 50.61 defines screening criteria for the embrittlement of RV materials in pressurized water reactors (PWRs) as well as actions required if these screening criteria are exceeded. The RV reference temperature for PTS, RT_{PTS}, will increase due to increasing neutron fluence, and the screening criteria specify limits on the RT_{PTS} values. The rule requires the RT_{PTS} values for all beltline materials to be maintained below the PTS screening criteria throughout the extended period of operation. For circumferential welds, the PTS screening criterion is 300 °F. For plates, forgings, and axial welds the PTS screening criterion is 270 °F.

A PTS evaluation for the RV beltline materials was performed in accordance with 10 CFR 50.61. Calculation of RT_{PTS} values is by addition of the initial RT_{NDT}, the predicted radiation-induced change in material properties (ΔRT_{NDT}), and a margin term (m) to account for uncertainties in the values of initial RT_{NDT}, copper and nickel contents, neutron fluence, and calculation procedures. Calculation of the predicted radiation-induced ΔRT_{NDT} is by use of the respective RV beltline material copper and nickel contents and the neutron fluence applicable to the RV material through 52 EFPY of operation.

Evaluations of the RT_{PTS} values for each RV beltline material were based on the tabulated chemistry factor values given in 10 CFR 50.61.

The RT_{PTS} values for the RV beltline materials at 52 EFPY were determined and the results of the PTS evaluation demonstrated that the RV beltline materials will not exceed the PTS screening criteria before the end of the period of extended operation. The controlling RV beltline material for TMI-1 is Circumferential Weld WF-70, with an RT_{PTS} value of 263.8 °F at 52 EFPY, which is well below the PTS screening criterion of 300 °F for circumferential weld materials.

4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 4.2.4 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis has been projected to the end of the period of extended operation.

10 CFR 50.61 provides the Commission's requirements for demonstrating that RVs in U.S. PWR facilities will have adequate protection against the consequences of PTS events throughout their licensed operating period. The rule requires licensees to calculate RT_{PTS} values for each base metal and weld material located in the beltline region of the RVs. The rule sets a screening limit of 270 °F for RT_{PTS} values that are calculated for base metals (i.e., forging and plate materials) and axial weld materials and a screening limit of 300 °F for RT_{PTS} values that are calculated for circumferential weld materials. The rule also provides an expanded discussion regarding how the calculations of RT_{PTS} values should be performed and describes two methods for determining RT_{PTS} values for RV beltline materials, depending on whether or not a given RV beltline material is represented in the plant's Reactor Vessel Material Surveillance Program.

The applicant provided its RT_{PTS} value assessments for the TMI-1 RV beltline materials in Table 4.2.4-1 of the LRA for TMI-1. The RT_{PTS} values listed in these tables were based on the neutron fluence values at the clad-to-base metal interface of the RV. According to Table IV A-2 of NUREG-1801, Revision 1, ferritic materials are subject to neutron embrittlement when they are exposed to a neutron fluence greater than 1×10^{17} n/cm^2 (E > 1 MeV) at the end of the extended period of operation. The applicant's neutron fluence values used to determine the RT_{PTS} values were based on the values that were projected to end of the extended period of operation (i.e., at 52 EFPY). The applicant reported that for TMI-1, Circumferential Weld WF-70 is the limiting material for PTS with a RT_{PTS} value of 263.8 °F at 52 EFPY. The initial RT_{NDT} for the Linde 80 welds was specified in BAW-2308, Rev. 2. Chemistry values were reported in BAW-1543A, Rev. 4, Supplement 4 and BAW-2325, Rev. 1. To verify the validity of the applicant's calculation of the RT_{PTS} values at 52 EFPY for TMI-1's limiting beltline materials, the staff performed independent calculations per 10 CFR 50.61 and found the RT_{PTS} values acceptable. The staff confirmed that Circumferential Weld WF-70 was the limiting beltline material for TMI-1. The staff calculated an RT_{PTS} value of 264.2°F for TMI-1 Circumferential Weld WF-70, which is in agreement with the applicant's calculation of 263.8°F, and is below the screening limit of 300°F for circumferential welds. The staff finds the RT_{PTS} values for all TMI-1 RV beltline materials to be acceptable because the bounding materials comply with the requirements specified in 10 CFR 50.61.

4.2.4.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of pressurized thermal shock limits for reactor vessel materials due to neutron embrittlement in LRA Section A.4.2.4. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant's actions to address pressurized thermal shock limits for reactor vessel materials due to neutron embrittlement is adequate.

4.2.4.4 Conclusion

Based on the technical assessments stated above, the staff concludes that the RV's at TMI-1 will maintain acceptable RT_{PTS} values throughout the expiration of the extended period of operation. The staff therefore concludes that the applicant's TLAA for PTS, as given in Section 4.2.4 of the LRA, is in compliance with the screening criteria specified in 10 CFR 50.61. Therefore, the staff concludes that the TMI-1 RV will be acceptable for PTS through the expiration of the extended period of operation.

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the TMI-1 RV PTS analysis has been projected to the end of the period of extended operation.

4.2.5 Reactor Vessel Operating Pressure – Temperature Limits, Including Adjusted Reference Temperatures and Low Temperature Overpressure Protection Limits

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 summarizes the evaluation of material adjusted reference temperature (ART) values and low temperature overpressurization protection (LTOP) limits for the period of extended operation. The ART is the value of a material's Initial RT_{NDT} plus ΔRT_{NDT} plus a margin term to account for uncertainties at a specific location. Neutron embrittlement increases a material's ART value; thus, the minimum temperature at which an RV is allowed to be pressurized increases over the licensed period. The ART value of the limiting beltline material is used to correct the RV beltline P-T limits to account for radiation effects.

LRA Section 4.2.5 also summarizes the evaluation of operating pressure-temperature (P-T) limits for the period of extended operation. In accordance with 10 CFR Part 50, Appendix G, P-T operating limits are specifically required for three categories of operation: (1) hydrostatic pressure tests and leak tests, (2) non-nuclear heat-up/cool-down and low-level physics tests, and (3) core critical operation. The P-T limits must be at least as conservative as limits obtained by the methods of analysis and margins of safety of Appendix G of the ASME Code, Section XI. The minimum temperature requirements pertain to the limiting material, which is either the highly stressed material in the closure flange region or a material in the beltline region with the highest ART value.

TMI-1 is currently operating to 29 EFPY P-T limit curves and LTOP limits. The applicant will submit updates to the P-T limit curves and LTOP limits prior to the period of extended operation, and prior to exceeding the 29 EFPY fluence values upon which the current P-T limits and LTOP limits are based.

4.2.5.2 Staff Evaluation

P-T limit curves are provided to specify the maximum allowable pressure as a function of reactor coolant temperature in order to prevent or minimize the effects of reduced fracture toughness caused by neutron irradiation. The curves are generated assuming that a 1/4T surface flaw exists using the fracture mechanics methodology in ASME Section XI, Appendix G. The P-T limit curves are not provided for the detection of aging effects, but rather to prevent or minimize the effects of reduced fracture toughness caused by neutron irradiation. The P-T limit curves are valid for a specified number of EFPYs. The curves must be updated before this time period is exceeded. This approach is acceptable since the validity of the curves is monitored and the P-T limit curves are updated prior to exceeding the applicable EFPY.

The staff reviewed LRA Section 4.2.5 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function will be adequately managed for the period of extended operation. LTOP limits are considered as part of the calculation of the P-T limit curves. The current TMI-1 P-T limit curves are valid out to 29 EFPY. The applicant committed to revise the P-T limits and LTOP limits before reaching 29 EFPY and will at that time project appropriate P-T limits to the end of the 60-year licensed operating period. The RV surveillance program is in place to monitor RV embrittlement. This program will provide data to update P-T limits, and therefore will permit the licensee to manage P-T limits going forward, in accordance with 10 CFR Part 54(c)(1)(iii).

4.2.5.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of reactor vessel operating pressure – temperature limits, including adjusted reference temperatures and low temperature overpressure protection limits in LRA Section A.4.2.5. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant's actions to address reactor vessel operating pressure – temperature limits, including adjusted reference temperatures and low temperature overpressure protection limits is adequate.

4.2.5.4 Conclusion

On the basis of its review, as discussed above, the staff concluded that the applicant has demonstrated, that for P-T limits and LTOP PORV setpoints, the analyses are current and have been projected to 29 EFPY. The applicant has committed to revise the P-T limits and LTOP PORV setpoints for the period of projected operation, which satisfies Appendix G of 10 CFR Part 50, and 10 CFR 54.21(c)(1)(iii).

4.2.6 Neutron Embrittlement of Reactor Vessel Internals

4.2.6.1 Summary of Technical Information in the Application

LRA Section 4.2.6 summarizes the evaluation of changes in the properties of the stainless steel and nickel-based alloys used in RV internals resulting from exposure to high-energy neutrons (E > 1.0 MeV). This neutron irradiation can result in changes to the RV mechanical properties, including a decrease in the ductility and fracture toughness of RV internals materials. The degree of neutron embrittlement is a function of the irradiation temperature and neutron fluence. Generally, RV internals components closest to the core experience the greatest extent of neutron embrittlement.

The effects of neutron embrittlement on the RV internals were evaluated for the current licensing basis in topical report BAW-10008, Revision 1, Appendix E. The analysis concluded that at forty years, the internals will maintain adequate ductility to absorb local strain at the regions of maximum stress intensity, and that neutron irradiation will not adversely affect deformation limits.

The applicant states that the analysis of neutron embrittlement of RV internals is a TLAA that will be managed by the PWR Vessel Internals program for the period of extended operation.

4.2.6.2 Staff Evaluation

The staff reviewed LRA Section 4.2.6, pursuant to 10 CFR 54.21(c)(1)(iii). The applicant stated that changes in mechanical properties of RV internals due to neutron embrittlement will be managed through the following activities of the PWR Vessel Internals program: (1) participating in the industry programs for investigating and managing aging effects on reactor internals, (2) evaluating and implementing the results of the industry programs as applicable to the RV internals, and (3) submitting an inspection plan for reactor internals to the NRC, for review and approval, not less than 24 months before entering the period of extended operation.

4.2.6.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of neutron embrittlement of reactor vessel internals in LRA Section A.4.2.6. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant's actions to address neutron embrittlement of reactor vessel internals is adequate.

4.2.6.4 Conclusion

Based on the applicant's commitment (Appendix A of the LRA, Commitment No. 36) to manage the effects of the aging of RV internals due to neutron embrittlement through participation in the PWR Vessel Internals Program, the staff concludes that the applicant can adequately manage the aging of RV internals due to neutron embrittlement for the period of extended operation.

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the applicant's processes will adequately manage the TMI-1 effects of aging of RV internals due to neutron embrittlement.

4.3 Metal Fatigue of Piping and Components

A metal component that is subjected to cyclic loads may fail at load levels lower than its design load carrying capacity due to a well-known phenomenon known as fatigue failure. Fatigue failure involves crack initiation and propagation. The fatigue life of a structural component depends on the material used for the structure, the environment to which the structural component is exposed, the number of occurrences or repetitions and magnitude of the applied fluctuating loads.

In LRA Section 4.3, the applicant states that metal fatigue was evaluated in the design process for pressure-retaining components, including the reactor pressure vessel, reactor coolant pumps, steam generators, pressurizer, piping, valves, and components of primary, secondary, auxiliary, steam, and other systems. The applicant further states that metal fatigue was also evaluated in the design of the reactor vessel internal components and the design analyses for these components have been determined to be TLAAs requiring evaluation for the period of extended operation. Furthermore, the applicant states that fatigue TLAAs for pressure boundary components are characterized by determining the applicable design codes and specifications that specify the fatigue design requirements.

Fatigue is age-related degradation caused by cyclic stressing of a component by either mechanical or thermal stresses. Fatigue analyses are TLAAs if they meet the six defined elements pursuant to 10 CFR 54.3(a). If the analyses are based on a number of cycles estimated for the current license term, they may meet the 10 CFR 54.3(a)(3) criterion of "defined by the current operating term." The applicant evaluates the TLAA in accordance with 10 CFR 54.21(c)(1) to determine which of the following conditions are demonstrated:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the period of extended operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation

4.3.1 Evaluation of Fatigue in ASME Class 1 and USAS B31.7 Piping and Components

4.3.1.1 Summary of Technical Information in the Application

LRA Section 4.3 states that fatigue analyses are potential TLAAs for Class 1 and for selected non-Class 1 pressure boundary components. The applicant further states that most of the key components of the reactor coolant pressure boundary (RCPB) were designed to the requirements for Class 1 components found in ASME B&PV Code, Section III, and that only a few components were designed to the USA Standard (USAS) B31.7.

LRA Table 4.3.1-1 shows the design codes used for each of the pressure-retaining components, and LRA Table 4.3.1-2 shows the monitored design transients and cycles. In LRA Section 4.3.1, the applicant states that each component designed in accordance with ASME Section III, Class A or Class 1 rules or in accordance with USAS B31.7 rules was shown to have a cumulative usage factor less than or equal to the design limit of 1.0.
The applicant further states that it has performed evaluations for unanticipated transients that were not considered in the original design. The applicant notes that the unanticipated transients include thermal stratification cycles and thermal striping of piping in the RCS system and insurge/outsurge transients associated with operation of the pressurizer and pressurizer surge line. The applicant also indicates that these components will be monitored under the Fatigue Monitoring Program described in LRA Section B.3.1.1 and the functional specifications have been revised accordingly. The applicant indicates that these revised analyses reflect the current design basis and resulted in CUF values less than or equal to 1.0.

Furthermore, the applicant indicates that it also has revised fatigue analyses for the High Pressure Injection (HPI) nozzles due to modifications in the testing procedures. These revised analyses reflect the current design basis (40-year transients) and the revised CUF values were shown to be within the limit of 1.0.

The applicant performs TLAA evaluations to determine whether the cumulative fatigue usage (CUF) is within the limit of 1.0 at the end of the period of the extended operation and the applicant monitors those transients that are significant contributors to fatigue usage to assure that the limits are not exceeded. To determine whether extending operation from 40 to 60 years is feasible, the applicant first attempted to multiply the 40-year design CUF values of the structural components by a factor of 1.5, ratio of 60 to 40, and found that three of all the components evaluated, as identified below, would have the 60-year projected CUF values exceeding the limit of 1:

(1) RV Outlet Nozzle
(2) Core Flood Venturi
(3) Pressurizer Spray Line Piping

The LRA states that fatigue of all Class 1 components will be managed using the Metal Fatigue of Reactor Coolant Pressure Boundary Program, pursuant to 10 CFR 54.21(c)(1)(iii), to assure that fatigue usage does not exceed the 1.0 limit during the period of the extended operation.

4.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the fatigue of these components will be adequately managed for the period of extended operation.

Since not all TLAAs will remain valid for 60-years if subject to 1.5 times the number of design transients, TMI-1 will manage fatigue of all Class 1 components using the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program. The staff finds the applicant's disposition, pursuant to 10 CFR 54.21(c)(1)(iii), acceptable because it is consistent with the GALL Report. However, further evaluation must be performed to determine appropriate transient cycle administrative limits that will be used to assure that these components satisfy the fatigue requirements during the period of the extended operation. The new transient cycle administrative limits will replace the transient design cycles as limits for those components that would otherwise fail to meet the fatigue requirements.

The staff notes that since the transient types and environments remain unchanged for an operating plant, the value of CUF for any structural component depends on the cycles that the plant actually experienced. The staff notes that the Metal Fatigue of Reactor Coolant Pressure Boundary Program relies on transient cycle monitoring to assure meeting the fatigue requirement during the period of the extended operation and this approach tracks the number of occurrences of significant thermal and pressure transients (significant events) and compares the cumulative cycles against the number of design cycles specified in the design specifications (or against the administrative cycles specified in the Metal Fatigue of Reactor Coolant Pressure Boundary Program). The applicant uses the projected cycles to evaluate the total cumulative usage factor for 60-years. The staff also notes that for this approach to work, none of the significant events tracked should produce stresses greater than those that would be produced by the design transients. Namely, the P-T characteristics, including their values, ranges, and rates, all must be bounded within those defined in the design specifications. During the AMP audit, the staff determined that the applicant did not provide this information in the Metal Fatigue of Reactor Coolant Pressure Boundary Program. In RAI B.3.1.1-1, dated September 29, 2008, the staff requested that the applicant provide additional information to justify that the monitored transient data remain bounded by those defined in the design specifications.

In its response to the RAI dated October 20, 2008, the applicant stated that in order to assure that the tracked events do not produce stresses greater than those produced by the design transients, the plant fatigue monitoring procedure provides detailed design transient descriptions and bases for review by control room operators during the logging of a transient. The applicant further stated that the fatigue monitoring procedure requires the fatigue monitoring engineer to review the plant operating logs semiannually and whenever an unusual reactor operating event occurs that would require abnormal coolant injections. A more detailed discussion can be found in SER Section 3.0.3.2.25.

Based on its review, the staff finds the applicant's response to RAI B.3.1.1-1 acceptable because the operational procedures that the applicant adopts for the transient events tracking are consistent with the GALL Report and conservative to ensure a valid cycle-based fatigue management program. Therefore, the staff's concern described in RAI B.3.1.1-1 is resolved.

4.3.1.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of ASME Class 1 and USAS B31.7 piping and component fatigue analysis in LRA Section A.4.3.1. On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address ASME Class 1 and USAS B31.7 piping and component fatigue analysis is adequate.

4.3.1.4 Conclusion

On the basis of its review, the staff concludes, pursuant to 10 CFR 54.21(c)(1)(iii), that the applicant has demonstrated that the effects of aging of the intended functions will be adequately managed during 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 Evaluation of Reactor Water Environmental Effects on Fatigue Life of Piping and Components (Generic Safety Issue 190)

LRA Section 4.3.2 discusses the evaluation of the effects of the reactor coolant environment on fatigue life of components and piping, Generic Safety Issue (GSI)-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life," for the period of extended operation. ASME Section III uses stress versus allowable cycle curves (S-N curves) based on tests in air to determine a fatigue usage factor. GSI-190 addresses the effects of the reactor coolant environment on fatigue life of components and piping. The unfavorable environment can significantly shorten the fatigue life of stressed components.

4.3.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2 discusses the environmental fatigue evaluations for the RCS piping and components. The analyses were performed based on the guidelines given in GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The applicant stated that the GALL Report contains recommendations on specific areas for which existing programs should be augmented for license renewal. The applicant further states that sample critical components applicable to Babcock and Wilcox plants are identified in NUREG/CR-6260, "Application of

NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," March 1995, as follows:

1a. Reactor vessel - shell
1b. Reactor vessel - lower head
2a. Reactor vessel - inlet nozzles
2b. Reactor vessel - outlet nozzles
3. Pressurizer surge line
4. High Pressure Injection/Makeup (HPI/MU) nozzle
5. Reactor vessel - core flood nozzle
6. Decay heat removal system piping (decay heat return line/core flood tee)

The applicant stated that the sample components can be evaluated by applying environmental life correction factors to the existing ASME Code fatigue analyses using formulas contained in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and in NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels." The applicant also stated that the methodology used to compute the environmental correction factor for nickel-alloy materials was based upon the paper entitled "Status of Fatigue Issues at Argonne National Laboratory," presented by Omesh K. Chopra at the EPRI Conference on Operating Nuclear Power Plant Fatigue Issues & Resolutions, August 1996.

The applicant stated that demonstrating that these components have an environmentally adjusted cumulative usage factor less than or equal to the design limit of 1.0 is an acceptable option for managing metal fatigue for the reactor coolant pressure boundary. The applicant performed environmental fatigue analyses for each of the locations listed above. The first step that the applicant took was to determine the environmentally assisted fatigue (EAF) correction factor, F_{en}, based on the guidance from the applicable NUREG for the material types (stainless steels or carbon/low alloy steels) and Chopra's report for nickel-alloys. The second step was to multiply these F_{en} factors by the design fatigue usage values of the corresponding structural components/locations. The applicant further multiplied the products by a factor of 1.5, the ratio of 60-year to 40-year, to account for the increased cycles for the period of extended operation. The final value is the EAF-adjusted CUF value of a structural component at the end of the period of extended operation.

In the initial environmental fatigue calculations the applicant identified four locations that would have the EAF-adjusted CUF values greater than 1.0 at the end of the period of extended operation. These locations are as follows:

(1) Reactor Vessel Lower Head at Instrument Nozzle Penetration Weld
(2) Reactor Vessel Outlet Nozzle
(3) Pressurizer Surge Line (elbow)
(4) Makeup/High Pressure Injection Nozzle

The applicant stated that to assure that these components will not exceed an EAF-adjusted CUF value of 1.0 during the period of extended operation, the Metal Fatigue of Reactor Coolant Pressure Boundary Program is adopted, pursuant to 10 CFR 54.21(c)(1)(iii), to manage environmental fatigue of each Class 1 component. The applicant stated that to achieve this goal, it is necessary to establish appropriate new transient cycle administrative limits that will replace the transient design cycles as limits for the affected components in the Metal Fatigue of Reactor Coolant Pressure Boundary Program.

Based on the projected cycles, the applicant indicated that all locations listed in this section have an EAF-adjusted CUF value within the limit of 1.0.

4.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the analyses remain valid for the period of extended operation.

As discussed in SER Section 4.3.2.1, the applicant relies on new transient cycle administrative limits to support its LRA. The staff noted that reestablishing the transient cycle administrative limits requires transient cycle monitoring and counting. The applicant used plant operating history, analyzed the data and established a basis to find the average rate for each transient over a period of time. The applicant projects the 60-year transient cycles based on the average transient occurrence actually accrued from the plant startup (April 19, 1974) through December 31, 2006. The applicant noted that there are 26.7 years in this baseline period since it excludes the 6 years (1979 to 1985), in which TMI-1 was shutdown due to the TMI-2 incident. The staff performed hand calculations to verify the results presented in LRA Table 4.3.2-3 and found that the 60-year cycle projection for each transient was obtained by multiplying the average event rates by 54. During the AMP audit, the staff asked why 54 instead of 60 years was used for the projections and the applicant responded that TMI-1 will have operated a total of 54 years when the renewed license expires. The staff finds this response acceptable because 54 years will be the total time that TMI-1 will have actively operated (based on original license term plus the renewal term and deducting the extended shutdown period) and thus, the projection should be made based on 54 years rather than for 60 years of operation.

The applicant indicated that to qualify for the fatigue requirements for the surge line environmental fatigue analyses, refinement on cycle projection for the heatup/cooldown transients is necessary. The applicant used three different methods to estimate the average event occurrence rate:

(1) Averaging based on data accrued from the plant startup through December 31, 2006. The applicant indicated that since there is a 6-year shutdown period, the averaging involves two base periods: Base period A: April 19, 1974 – March 29, 1979 (5 years) and Base period B: April 10, 1985 – December 31, 2006 (21.7 years). There are 25 cycles accrued in base period A and 24 cycles accrued in the base period B. The applicant thus determined the average event rate being (25+24)/(5+21.7) = 1.835 per year, and projected the future cycles (January, 2007 through April, 2034, 27.3 years) being 1.835*27.3 = 50 cycles. Adding to it the 49 cycles from the baseline period (plant startup through December 31, 2006) results in 99 cycles. The staff performed hand calculations and confirmed the results presented in LRA Table 4.3.2-4. The staff noted that this method is exactly the same as the method described in the preceding paragraph.

(2) Averaging based on data accrued between April 10, 1985 and December 31, 2006.

For this method the applicant dropped base period A and used the data from base period B alone. The applicant determined the average event rate being 24/21.7 = 1.106 per year, and projected the future cycles (January, 2007 through April, 2034, 27.3 years) being 1.106*27.3 = 30 cycles. Adding to it the 49 cycles from the baseline period (plant startup through December 31, 2006) results in 79 cycles. The staff performed hand calculations and confirmed the results presented in LRA Table 4.3.2-4. The applicant slightly rounded up the results to 80 cycles and indicates that 80 cycles of heatup and cooldown transients were used for the revised fatigue evaluations for the surge line environmental fatigue analysis. The applicant stated that the first five year's data should be excluded from the averaging process because adjustments were involved in the initial stage of the plant operation and the situation gradually stabilized thereafter.

(3) Averaging based on data accrued between January 1, 1997 and December 31, 2006. For this method the applicant considered only the last 10 years of base period B. The applicant indicated there were 7 heatup/cooldown events accrued. The applicant determined the average event rate being 7/10 = 0.7 per year, and projected the future cycles (January, 2007 through April, 2034, 27.3 years) being 0.7*27.3 = 20 cycles (the applicant rounded it up from 19.11). Adding to it the 49 cycles from the baseline period (plant startup through December 31, 2006) results in 69 cycles. The staff performed hand calculations and confirmed the results presented in LRA Table 4.3.2-4.

The staff evaluated the above methods, as described below:

Of the three methods the applicant presented, Method 2, which the applicant selected for supporting its license renewal application, was deemed most reasonable. Herein the staff evaluated the validity of Method 2. From sample size viewpoint, Method 2 covers 81% of the time window (21.6 of the 26.7 years) as it excludes the first 5 years. It is understood that the portion of the time that is excluded has the highest instantaneous event occurrence rate and so it may raise concerns for underestimating. However, the staff noted that several other aspects about Method 2 should be considered, as described below:

(a) 81% of time window coverage is significant for building a basis for making creditable predictions by any standard.

(b) The portion of time that is excluded is the first 5 years after the plant initial startup. In the initial stage of any complex process, a learning curve is often unavoidable and associated procedural adjustments may be required until a comfortable level is established.

(c) The transient occurrence rate obtained from this method (and the other 2 methods as well) was only used for predicting the cycles that would occur in the future. The baseline cycles (49), which is to be added to the projected future cycles, have included those cycles that occurred in the first 5 years.

Based on its review and evaluation described above, the staff finds the applicant's selection of Method 2 to make the 60-year cycle projection for heatup/cooldown transients (for surge line components) acceptable for the following reasons:

(a) Method 2 produced a reasonable transient occurrence rate, 1.106 per year, which gives a good margin towards the standard refueling rate of 0.67 per year. The margin is 8 events over 20 years, as calculated by (1.106 - 0.67)x20 = 8.7 → 8.

(b) Although Method 1 is based on the all-time data, it will keep the pressurizer surge line locations from meeting the environmental fatigue requirements. Method 3 produced a very aggressive event occurrence rate, 0.7 per year, so aggressive that it matches the standard refueling rate (0.67 per year) and leaves no room for errors. In other words, Methods 1 and 3 are not viable.

For the HPI/MU nozzle (High Pressure Injection/Makeup Nozzle), the applicant divides the fatigue usage into three portions: (1) the portion that is due to the valve test cycles; (2) the portion that is due to HPI non-test actuation cycles; and (3) the portion that is due to 40-year design numbers of Reactor Trip and Rapid RCS Cooldown cycles. The staff finds such a division acceptable because it is for administrative purposes and for reasons described below. The applicant indicates that the HPI valve testing method was revised in 2001, after 35 occurrences, by performing the test during outages when the reactor head is removed. Therefore, after 2001, the valve testing involves no thermal effects. Previously, the valve testing was performed while the plant was running. Thus, after the testing method revision, fatigue due to the valve tests would be negligible and no longer will there be environmental fatigue effects associated with the valve tests. As for the HPI non-test actuation transient, the original administrative cycle limit, 59, would keep the HPI/MU nozzle from meeting the environmentally assisted fatigue requirements. Therefore, to meet the fatigue requirement during the period of the extended operation, monitoring for the HPI non-test actuation transient is required. The applicant states that only 3 non-test HPI actuation cycles occurred during the baseline period (26.7 years) and it is projected that a total of 6 cycles will occur for 60 years of plant operation. The applicant sets the HPI non-test transient new administrative cycle limit to 35. The staff finds this is acceptable because the environmentally assisted fatigue factor at the HPI/MU nozzle will be within the limit of 1.0 based on this administrative cycle limit, which bounds the projected 60-year cycles of 6.

The applicant indicated that the operation of the power change transients (0% - 15% power and 15% - 0% power) is associated with recovery from reactor trip, turbine trips, and step load reduction (100% to 8% Power) events. The applicant also indicates that the power change transients are not currently tracked but the administrative limit is reduced to 480 cycles from 1440 for the surge line environmental fatigue analyses. The staff finds the 480 cycles of administrative limitation for the power change transients reasonable because the total of projected 60-year cycles of reactor trips and step load reduction altogether is estimated to be 4+75+43=122. See LRA Table 4.3.2-3. The estimate is acceptable because (1) the power change transients are triggered by the reactor trips and step load reduction events, and (2) the estimated cycles, 122, is well bounded by the 480 cycles that is used for the new administrative cycle limit for this particular transient.

LRA Section 4.3.2, (in the last sentence of the third paragraph under the section titled "*Reduced Transient Cycle Administrative Limits – Pressurizer Surge Line")*, states the following: The F_{en} environmental correction factors shown are the overall average for each analysis. The staff determined that additional information regarding this statement was required because it could mean the average of F_{en} of all of the transients together for a single location, or the two-way average of F_{en} of all of the transients together and of all locations having the same material. The staff notes that since fatigue is localized damage, cross-location averaging of F_{en} values is inappropriate and would lead to non-conservative fatigue usage predictions. In RAI 4.3.2-1, dated September 30, 2008, the staff requested that the applicant provide additional information to clarify the environmental correction factors.

In its response to the RAI, dated October 23, 2008, the applicant stated that the phrase "overall average for each analysis" means the average F_{en} correction factor (or multiplier) for all of the transients together for a single location, and points out that the phrase "overall average" applies to the results from the refined fatigue analyses for Locations 3a and 3b in Table 4.3.2-2 of the LRA. The applicant also stated that in the analyses of these two locations, an individual F_{en} correction factor was computed for selected load set ranges (transient parings) based upon the equations provided in Section 4.1 of EPRI MRP-47, Revision 1 and that each individual F_{en} factor was computed using only data appropriate for the location and for the transient pairing. The applicant stated that no multiple locations averaging were involved.

The staff reviewed EPRI report MRP-47, Revision 1, to verify validity of the equations that the applicant used, as indicated in its response to RAI 4.3.2-1, for its environmental fatigue calculations and confirmed that MRP-47 uses the same algorithms recommended in NUREG/CR-6583 for carbon steels and low alloy steels and in NUREG/CR-5074 for austenitic stainless steels.

The applicant further indicated that the values reported as F_{en} factors in Table 4.3.2-2 are a composite of the overall average F_{en} for the fatigue analysis and cycle reduction factor, and are computed by dividing the EAF-adjusted CUF value of the component by the current design CUF value of the component.

Based on its review, the staff finds the applicant's response to RAI 4.3.2-1 acceptable because the EAF-adjusted analyses were performed based on EPRI MRP-47 which involves no multi-location interaction. The applicant determined F_{en} factors individually, for each transient pair in the computing process and obtained the partial EAF-adjusted CUF. The applicant took the summation to obtain the total EAF-adjusted CUF value contributed by all transients. The staff notes that the F_{en} values shown in Column labeled "F_{en} Correction Factor" LRA Table 4.3.2-2 may be considered as equivalent-F_{en} values, obtained by dividing the values under Column labeled "Environmental CUF" by the corresponding values under Column labeled "Inside Surface CUF."

The staff notes that the data shown in the column labeled "Inside Surface CUF" are 40-year design CUF values. However, as shown in LRA Tables 4.3.2-3 and 4.3.2-4, since the 40-year design cycles are greater than the projected 60-year cycles, determining the 60-year EAF-adjusted CUF by multiplying the 40-year design CUF value by the corresponding equivalent F_{en} value is conservative.

On the basis of the staff's review as described above, the staff's concern of the F_{en} factor averaging method as described in RAI 4.3.2-1 is resolved because there was no cross location or multiple location averaging involved. The staff's concern described in RAI 4.3.2-1 is resolved. Additionally, as shown in LRA Tables 4.3.2-1 and 4.3.2-5 and some intermediate tables, a single value of F_{en} is used for the low alloy steel, disregarding the locations/components that they are associated with. The same situation is seen for the locations which use Alloy 600 material. However, F_{en} is a function of strain rate, dissolved oxygen concentration, and temperature. As a result, a F_{en} factor is expected to be different for each location because strain rates are likely to be different for each component and location. In RAI 4.3.2-2, dated

September 30, 2008, the staff requested that the applicant provide additional information to clarify the strain rates.

In its response to the RAI dated October 23, 2008, the applicant stated that maximum F_{en} values were computed for each material type by using bounding assumptions for each input variable in the applicable F_{en} equations. These maximum F_{en} values were used as a first attempt to qualify each of the NUREG/CR-6260 locations for environmental fatigue effects. The applicant obtained the maximum F_{en} values for carbon steel, low alloy steel, austenitic stainless steel, and nickel alloy 600 as 1.74, 2.455, 15.35, and 1.49, respectively. The maximum F_{en} approach, in combination with reduced numbers of transient cycles, was successful for qualifying each location except Locations 3a and 3b. Refined fatigue evaluations were performed for these two locations, where individual F_{en} factors were computed and utilized as described in the response to RAI 4.3.2-1.

The staff finds the applicant's response to RAI 4.3.2-2 acceptable because the applicant used the maximum F_{en} value for its environmental fatigue adjustment. The maximum F_{en} values for each of the applicable materials can be calculated using equations in NUREG/CR-6583 for carbon steels and low alloy steels and in NUREG/CR-5074 for Austenitic stainless steels. The staff performed hand calculations to verify the maximum F_{en} values. The staff notes that the maximum F_{en} values for carbon steels and low alloy steels (1.74, 2.455, respectively) from the applicant's response to the RAI, involves an assumed DO (dissolved oxygen) concentration level of 0.05 ppm. For stainless steels, the maximum F_{en} (15.35) requires a temperature T > 200 ^{o}C, strain rates $\dot{\varepsilon}$ less than 0.0004% per second, and DO levels less than 0.05 ppm. In a letter dated April 29, 2009 the applicant confirmed that the assumed dissolved oxygen value of less than 0.05 ppm is the bounding value. The applicant stated that during power operations in the last three operating cycles, the measured dissolved oxygen concentration has normally been less than 0.005 ppm and has not exceeded 0.027 ppm.The applicant further stated that a sampling of data for the period 1974 – 1979 identified that the dissolved oxygen concentration in the reactor coolant during power operations was less than 0.050 ppm. The maximum F_{en} value of 1.49 for Nickel Alloy 600 can be found in the paper entitled "Status of Fatigue Issues at Argonne National Laboratory," presented by Omesh K. Chopra at the EPRI Conference on Operating Nuclear Power Plant Fatigue Issues & Resolutions, August 1996. The staff notes that the EPRI technical information (presented by Omesh K. Chopra) quoted herein for Alloy 600 F_{en} calculations can be found in NUREG/CR-6335, titled "Fatigue Strain-Life Behavior of Carbon and Low-Alloy Steels, Austenitic Stainless Steels, and Alloy 600 in LWR Environments," authored by J. Keisler, O. K. Chopra, and W. J. Shack, dated August 1995. On the basis of the staff's review as described above, the staff's concern described in RAI 4.3.2-2 is resolved.

The staff noted that the applicant made corrections to the LRA after it was submitted on January 8, 2008. On April 8, 2008, the applicant informed the staff of corrections by submitting a supplement, titled "Corrections to the Three Mile Island Nuclear Station Unit 1 License Renewal Application." One of the areas identified in the LRA supplement is applicable to the environmental fatigue TLAA, as discussed below:

> Affected Section: 4.3.2 – Evaluation of Reactor Water Environmental Effects on Fatigue Life of Piping and Components (Generic Safety Issue 190)
>
> LRA Page Numbers: 4-32, 4-33 and 4-38
>
> Tables: Table 4.3.2-2, TMI-1 Pressurizer Surge Line Environmental Fatigue Results

Table 4.3.2-5, Final Environmental Fatigue Analysis Summary for NUREG/CR-6260 Locations

Change: This change incorporates updated analysis results for environmental fatigue of pressurizer surge line nozzles and safe ends (locations 3c and 3d). All environmentally adjusted cumulative usage factor (CUF) values remain acceptable, below the code limit of 1.0 for 60 years

The staff reviewed the environmental fatigue TLAA portion of the LRA supplement. The applicant stated that none of the corrections involve design base changes except that 40-year cycles instead of the reduced cycles are now used for calculating the CUF for the hot leg nozzle safe end. The applicant noted that this was done for consistency purposes so that all of the analyzed locations associated with the nozzles, safe ends, and weld overlays are based upon the same number of transient cycles, which is the 40-year design numbers. The staff noted that this is conservative because larger cycles are used for the analyses. Another facet indicated in the LRA supplement concerns the EAF correction factor or multiplier, F_{en}, in which the value 1.74 is now used, replacing 2.455, for the hot leg nozzle and pressurizer surge nozzle, both of which are carbon steel materials. The staff noted that 2.455 is the maximum F_{en} value applicable to low alloy steels, whereas 1.74 is the maximum F_{en} value for carbon steels. The staff noted that the modification is appropriate because now the location under consideration is evaluated based on the actual material used for the location, carbon steel. The applicant stated that the final EAF-adjusted CUF values for Locations 3c and 3d are now greater than those shown in the original LRA but still are within the acceptable limit of 1.0. The corrected Table 4.3.2-5, which shows the EAF-adjusted CUF for the NUREG/CR-6260 locations, is reproduced below.

Enclosure A
Corrections in the Main Body of the TMI Unit 1 LRA

Table 4.3.2-5 Final Environmental Fatigue Analysis Summary for NUREG/CR-6260 Locations

Location No.	Component	Limiting Material Type	Inside Surface CUF	Fen Multiplier	EAF Adjusted CUF	P/F
1a	Reactor Vessel Shell and Lower Head - Lower Head near Support Skirt	Low Alloy Steel	0.004	2.455	0.010	Pass
1b	Reactor Vessel Lower Head – Instrument Nozzle Penetration Weld	Nickel Alloy 600	0.564	1.49	0.840	Pass
2a	Reactor Vessel Inlet Nozzle	Low Alloy Steel	0.008	2.455	0.020	Pass
2b	Reactor Vessel Outlet Nozzle	Low Alloy Steel	0.252	2.455	0.619	Pass
3a	Pressurizer Surge Line (elbow)	Stainless Steel	0.399	2.383	0.951	Pass
3b	Surge Line – Piping Non-Elbow bounding pipe location	Stainless Steel	0.375	2.259	0.847	Pass
3c	Safe End	Stainless Steel	***0.063*** ~~0.0358~~	15.35	***0.967*** ~~0.550~~	Pass
3d	Pressurizer Surge Nozzle ~~Forging~~	Carbon Steel	***0.3909*** ~~0.0056~~	***1.74*** ~~2.455~~	***0.680*** ~~0.0137~~	Pass
4	Makeup/High Pressure Injection Nozzle	Nickel Alloy 600	0.656	1.49	0.977	Pass
5	Reactor Vessel Core Flood Nozzle	Low Alloy Steel	0.198	2.455	0.486	Pass
6	Decay Heat Removal System Return Line Class 1 Piping	Stainless Steel	0.0213	15.35	0.327	Pass

Based on its review, the staff finds the LRA supplement acceptable because the changes result in the analyses being more conservative.

4.3.2.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA on effects of reactor water environmental effects on fatigue life of components and piping (GSI-190) in LRA Section A.4.3.2. On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address effects of reactor water environmental effects on fatigue life of components and piping (GSI-190) is adequate.

4.3.2.4 Conclusion

The staff concludes that the applicant's selecting of Method 2 to make the 60-year cycle projection for heatup/cooldown transients (for surge line components) is acceptable.

On the basis of its review, including the applicant's responses to the RAIs, and the corrections to the LRA, the staff concludes that, pursuant to 10 CFR 54.21(c)(1)(iii) the applicant has demonstrated that the effects of regarding reactor water environmental effect on fatigue life of piping components would be adequately managed 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 ASME Class 2 and 3 and USAS B31.1 Piping and Component Fatigue Analysis

4.3.3.1 Summary of Technical Information in the Application

LRA Section 4.3.3 states that piping designed in accordance with ASME Section III Class 2 or 3 rules, or with the USAS B31.1 Piping Code was not required to have an analyses of cumulative fatigue usage, but effects of fatigue were considered in a simplified manner in the design process. The fatigue requirement is satisfied if the total number of thermal cycles from all transients expected during the 40-year lifetime of these components is within the 7,000-cycles. If the 7,000-cycle limit is exceeded, appropriate stress range reduction factors must be applied to the allowable stress range for secondary stresses to account for thermal cycling.

The applicant concluded based upon the transient projection results discussed in LRA Section 4.3.3, that the numbers of cycles expected to occur in 60-years will not exceed the 7,000-cycle limit and the fatigue requirements for the Class 2 and 3 components will be satisfied during the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(iii).

4.3.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the fatigue of these components will be adequately managed for the period of extended operation.

The staff noted that no explicit fatigue evaluation is required for Class 2 and 3 components designed according to ASME III or USAS 31.1 Codes. Furthermore, for Class 2 and 3 components, the fatigue requirement is met if the total number of cycles of all transients for these structural components experienced during the license term is kept within 7,000-cycles. LRA Section 4.2 shows that all transients that are tracked have 60-year projected cycles fewer than the total number of cycles used in the original piping design. The staff noted that Class 2 and 3 components are associated mostly with heatup/cooldown transients, which are limited to 240 cycles. As per LRA Table 4.3.2-3, adding all cycles applicable to Class 1 components, the projected 60-year cycles are well below the 7,000 cycle limit, noting that steady state fluctuations and load/unload cycles would not be applicable to Class 2 and 3 piping. Based on its review, the staff finds the applicant's claim that TMI-1 Class 2 and 3 components will continue to meet the fatigue requirements during the period of extended operation, acceptable.

4.3.3.3 UFSAR Supplement

The applicant provided an UFSAR Supplement summary description of its TLAA evaluation for ASME Class 2 and 3 and USAS B31.1 piping and component fatigue analysis in Section A.4.3.3 of the LRA. On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address ASME Class 2 and 3 and USAS B31.1 piping and component fatigue analysis is adequate.

4.3.3.4 Conclusion

On the basis of the review of the LRA the staff concludes that the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii) that the effects of aging regarding ASME Class 2 and 3 and USAS B31.1 piping and components will be adequately managed 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).

4.3.4 Reactor Vessels Internals Fatigue Analysis

4.3.4.1 Summary of Technical Information in the Application

LRA Section 4.3.4 discusses the fatigue analyses for reactor vessel internals and states that the RV internals were designed and constructed prior to the development of ASME Code requirements for core support structures. The applicant stated that the design of the RV internals had followed the reactor coolant system functional design requirements and that the RV internals were implicitly designed for low cycle fatigue based upon the reactor coolant system design transient projections for 40 years, which has been identified as a TLAA.

The applicant indicated that the cycles of the original design transients will be used as limits in the Metal Fatigue of Reactor Coolant Pressure Boundary Program, in accordance with 10 CFR 54.21(c)(1)(iii), which monitors transient cycles to assure they do not exceed their design limits.

4.3.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.4 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the fatigue of these components will be adequately managed for the period of extended operation.

The design transient cycles shown in LRA Table 4.3.1-2 were implicitly used in the original design of the reactor vessel internals to determine qualification of the fatigue requirements. LRA Tables 4.3.2-3 and 4.3.2-4 contain the results of projected 60-year cycles. The staff notes that while the cycles shown in these tables were intended for addressing environmental fatigue, the results show that the projected 60-year cycles are bounded by the 40-year design cycles shown in Table 4.3.1-2 for all transients. Based on its review, the staff finds the applicant's approach of using the original design cycles as limits in the Metal Fatigue of Reactor Coolant

Pressure Boundary Program, pursuant to 10 CFR 54.21(c)(1)(iii), acceptable because the design analyses meet the fatigue requirements based on the original transient design cycles, which bound the 60-year projected cycles.

4.3.4.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of the TLAA evaluation of reactor vessel internals fatigue in LRA Section A.4.3.4. On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address reactor vessel internals fatigue is adequate.

4.3.4.4 Conclusion

On the basis of the review of the LRA, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging regarding RV internals fatigue analysis will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.5 Reactor Vessel Internals Flow-Induced Vibration Analysis

4.3.5.1 Summary of Technical Information in the Application

LRA Section 4.3.5 discusses reactor vessel internal flow-induced vibration (FIV) evaluations and identified it as a TLAA. The applicant stated that the components analyzed included the stainless steel incore instrumentation nozzles, the incore instrumentation guide tubes, the flow distributor, the flow distributor assembly support plate, the thermal shield, the inlet baffle, and bolting. The applicant also stated that these components are austenitic stainless steel products and that the S-N curves applicable for these stainless steel components are shown in Figure I-9.2.2 of ASME Section III. The applicant further indicates that the number of cycles postulated for the 40-year plant life was 10^{12} cycles.

The applicant indicates that the ASME S-N curve for stainless steels covers up to 10^{11} cycles and therefore an extrapolation of the S-N curve is necessary to accommodate the fatigue life which exceeds 10^{11} cycles. The applicant performed linear extrapolation of the S-log(N) curve, and extended the curve to 10^{13} cycles to allow coverage through the period of extended operation. The LRA states that for the 40-year baseline period, the maximum alternating stresses for each of these components were below the applicable alternating stress endurance limits and would therefore not develop fatigue cracking.

Using the expanded S-N curve, the applicant obtained an endurance limit corresponding to 10^{13} cycles. The applicant assumed a 4% reduction in endurance limit per decade of alternating cycles for the life beyond 10^{11}, along with a 0.9 factor to account for reduction in Young's modulus (since the S-N curve was established based on the material tests performed at the room temperature whereas the plant is operating at higher temperatures). For PWR plants, 600 °F temperature is typical.

The applicant obtained a 13,700 psi endurance limit corresponding to 10^{13} cycles, which bounds the maximum alternating stress (8,260 psi) for any of the RV internal components with a margin of about 39%. The applicant concluded that FIV would not cause fatigue failure to the RV internal components during the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(ii).

4.3.5.2 Staff Evaluation

The staff reviewed LRA Section 4.3.5 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The staff finds the applicant's approach of finding the "endurance limit" by extrapolating the ultra high cycle portion of the S-N curve acceptable as discussed below:

The staff noted that for austenitic alloys such as stainless steels, the "endurance limit" steadily reduces as the number of applied stress cycles increases. This is demonstrated in Figure I-9.2.2 of ASME Section III, Division 1 Appendices, which shows a linear relationship between the alternating stress, S_a, and the fatigue life, N (with N in logarithmic scale), starting from the 8^{th} decade of the fatigue life. The staff noted there is a companion table, ASME Table I-9.2.2, of ASME Figure I-9.2.2, which provides the same S_a versus N data except in digital form. To facilitate its review, the staff reproduced a segment of ASME Table I-9.2.2, matching Curve B, which is applicable to the present evaluation.

The staff reviewed this part of the LRA, as described below:

N (cycles)	Sa (ksi)
108	17.0
109	16.8
1010	16.6
1011	16.5

The above data show that over three decades, from $N=10^8$ to $N=10^{11}$, the "endurance limit" drops only 0.5 ksi. The staff noted that this gives an average rate of reduction in endurance limit a value of 0.167 ksi per decade of cycles. Equivalently, the endurance limit reduction rate is approximately 1% per decade of cycles (0.167/16.5) based on the last point of curve B of ASME Figure I-9.2.2, which is equivalent to the last data pair in the above table. Note that the applicant used a 4% reduction per decade of cycles to make its endurance limit projection, which is conservative and acceptable.

The staff notes that the S-N curve shown in ASME Figure I-9.2.2 is established for room temperature, T=70 °F. Therefore, when applying the S-N curve to components operating at higher temperatures, an adjustment to the S-N curve must be made. This is known as elastic modulus correction, which shifts the fatigue curve down by some computable amount. The staff noted the elastic modulus for stainless steels at room temperature is $E=28.3 \times 10^6$ psi. At a typical PWR operating temperature of $T=600\ ^oF$, $E=25.3 \times 10^6$ psi for the stainless steels. The staff found these material data from Table TM-1, ASME Section III Part D. The required elastic modulus reduction factor is readily calculated by dividing $E_{600}=25.3 \times 10^6$ psi by $E_{70}=28.3 \times 10^6$ psi, which gives 0.894. The applicant used 0.90 which is acceptable because it is conservative.

On the basis of its review described above, the staff finds that the endurance limit (corresponding to $N=10^{13}$ cycles) the applicant calculated, 13,700 psi, is conservative and acceptable because the applicant used a much larger cycle reduction rate of 4% per decade versus 1% per decade which the staff estimated, to calculate the endurance limit. The staff notes that the maximum alternating stress of 8,260 psi in any of the RV internal components, is well below the endurance of 13,700 psi, by an ~ 39% margin.

4.3.5.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of reactor vessel internals flow-induced vibration analysis in LRA Section A.4.3.5. On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address reactor vessel internals flow-induced vibration analysis is adequate.

4.3.5.4 Conclusion

On the basis of the review of the LRA, the staff concludes that the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii) that the CLB analyses for RV internals flow-induced vibration analysis have been projected to the end of the period of extend operation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.6 Underclad Cracking Evaluation For Reactor Vessel

4.3.6.1 Summary of Technical Information in the Application

Underclad cracking has been detected in RV components that are fabricated from SA508, Class 2 forgings whose internal cladding was welding using a high heat submerged arc weld process. BAW-2274 (BAW-2251, Appendix C), contains an analysis of underclad cracking, which was performed as part of the Generic License Renewal Program for B&W plants using current ASME Code requirements and 48 EFPY fluence values. This analysis updates and supersedes the fracture mechanics analysis for underclad cracking as originally reported in BAW-10013. BAW-2274 evaluated three vessel regions: the nozzle belt, the closure head-to-head flange, and the beltline. The TMI-1 beltline plates are fabricated from SA 302, Grade B material, which is not susceptible to underclad cracking. Therefore, the beltline materials did not require analysis.

In BAW-2274, the controlling nozzle belt forging used in the evaluation was Oconee, Unit 3 forging 4680, with an adjusted RT_{NDT} at the 1/4T location of 159°F. The adjusted RT_{NDT} at the 1/4T location for TMI-1 nozzle belt forging ARY-59 at 52 EFPY was calculated to be 125.7°F, in comparison to 118°F reported in BAW-2274, Table 2-1 for 48 EFPY. The TMI-1 nozzle belt forging remains bounded by the BAW-2274 fracture mechanics analysis. BAW-2274, Table 2-2, indentified the limiting closure flange material based on an inside surface fluence of 7.78 x 10^{16} n/cm^2. For TMI-1, the fluence at 52 EFPY at the closure flange is 7.653 x 10^{14} n/cm^2, and therefore remains bounded by the BAW-2274 analysis. The analysis of underclad cracking reported in BAW-2274 remains valid for TMI-1 for 52 EFPY, based on a comparison of the fracture toughness properties evaluated in BAW-2274 with the 52 EFPY fluence projections for TMI-1. The fracture toughness margin for emergency and faulted conditions was 2.42, which is greater than the required toughness margin of 1.41.

In this section of the LRA, the applicant stated that since the updated analysis is based upon 40-year design transients, TMI-1 will continue to manage fatigue for these components using the 40-year design transient cycle limits in the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program.

4.3.6.2 Staff Evaluation

Topical Report BAW-2274 provides a fracture toughness and flaw growth analysis for underclad cracks that are postulated in the internal cladding of SA-508 Class 2 or 3 alloy steel components of B&W RVs. The staff accepted the fracture toughness and flaw growth analyses in BAW-2274 (BAW-2251, Appendix C) in a safety evaluation (SE) dated June 4, 1999 (ML0036702804). BAW-2274 included a PTS analysis. The staff concluded that neither the design basis transients nor the non-design basis transients will challenge the integrity of the vessel. The limiting RT_{PTS} values at the inner surface for ANO-1, Oconee-1, Oconee-2, and TMI-1 forgings at 48 EFPY were 90 °F, 136 °F, 113 °F, 175 °F, and 127 °F, respectively.

The staff independently calculated an RT_{PTS} of 133 °F for the TMI-1 nozzle belt forging ARY-59, using a fluence value at the wetted surface of 1.836 x 10^{19} n/cm^2 at 52 EFPY. This is higher than the RT_{PTS} value at 48 EFPY of 127 °F at the inner surface, from Table 2-1 of BAW-2274, but still significantly below the bounding inner surface RT_{PTS} value of 175 °F for the Oconee, Unit 3 nozzle belt forging. Therefore, the staff review determined that the updated adjusted reference temperature for the TMI-1 nozzle belt forging ARY-59 at 52 EFPY is less than the adjusted reference temperature of the limiting nozzle belt forging (Oconee, Unit 3 forging 4680) used in the BAW-2274 evaluation and does not affect the selection of the limiting nozzle belt material. Staff review determined that the fluence at 52 EFPY at the closure flange is less than the surface fluence analysis used in the BAW-2274 evaluation. Therefore, the TMI-1 nozzle belt forging and closure flange remain bounded by the BAW-2274 fracture mechanics analysis.

4.3.6.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of underclad cracking evaluation for reactor vessel in LRA Section A.4.3.6. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant’s actions to underclad cracking evaluation for reactor vessel is adequate.

4.3.6.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the applicant has projected the analysis for underclad cracking to the end of the period of extended operation. Since the updated analysis is based on 40-year old transient designs, pursuant to 10 CFR 54.21(c)(1)(iii), the applicant will adequately manage fatigue for these components using the 40-year design transient cycles as limits in the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program.

4.3.7 Reactor Coolant Pump Motor Flywheel Fatigue Crack Growth Analysis

4.3.7.1 Summary of Technical Information in the Application

LRA Section 4.3.7 discusses reactor coolant pump motor flywheel fatigue crack growth analysis. The analysis, which was performed by Westinghouse and documented in WCAP-14535A, includes a crack growth computation for a postulated radial flaw. The purpose of WCAP-14535A as stated within the document was to provide an engineering basis for elimination of flywheel inservice inspection requirements for all operating Westinghouse plants and for certain Babcock and Wilcox plants which specifically includes TMI-1. The WCAP-14535A Report included a critical crack size assessment based on a 1500 rpm of flywheel angular speed. WCAP-14535A provides the fatigue crack growth analyses results for an assumed radially oriented crack. The initial crack depth used in the analysis was 10% of the radial distance from the keyway to the outer rim of the flywheel. In the crack growth analysis, 6,000-cycles at a speed of 1,200 rpm was used. This is the transient condition and cycles postulated for 40 years of operation. The applicant concluded based on the WCAP results that the fatigue crack growth for the assumed flaw was negligible and no structural failure would occur when the flywheel speed is limited within 1500 rpm.

The applicant states in the LRA that the number of cycles applicable to the flywheel is the same as the number of RCP start-stop actions and these RCP actions are associated with plant heatups and cooldowns events. Thus, based on the design cycles for heatup and cooldown transients, the applicant indicates that there are 240 cycles applicable to the flywheel over 40 years. Projecting to 60 years, the applicant indicates there are 360 cycles for which the postulated crack in the flywheel would experience the most significant stress intensity factor. The applicant argued that the projected number of RCP starts and stops is not expected to exceed 6,000 cycles during the period of extended operation. The applicant disposes this flywheel TLAA to 10 CFR 54.21(c)(1)(ii).

4.3.7.2 Staff Evaluation

The staff reviewed LRA Section 4.3.7, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the analysis has been projected to the end of the period of extended operation.

RG 1.14, Revision 1, “Reactor Coolant Pump Flywheel Integrity” provides the staff’s recommended acceptance criteria for material and minimum fracture toughness properties of SA 508, Classes 2 and 3, materials and SA 533 Grade B, Class 2, materials used in the fabrication of U.S. RCP flywheels. RG 1.14, Revision 1, also provides guidelines for performing structural integrity assessments of the RCP flywheels in U.S. light-water reactors, including assessments for ensuring the integrity of the flywheels against unacceptable fatigue-induced crack growth failures.

The applicant indicated that the fatigue crack growth assessments are based on the number of start-stop cycles assumed in the design specifications for the pumps. Therefore, to meet the 10 CFR 54.21(c)(1)(ii) acceptance criterion, the applicant indicated that it must demonstrate that the total number of RCP start-stop cycles, projected through the end of the extended periods of operation, will be bounded by the number of RCP start-stop cycles assumed in the fatigue crack growth analysis for the RCP flywheels.

The staff reviewed WCAP-14535A and confirmed that 6,000 start-stop cycles were assumed for the fatigue crack growth analysis. Based on this consideration, the staff finds the applicant’s claim that the flywheel will maintain its structural integrity during the period of the extended operation acceptable because the number of start-stop cycles projected for 60 years is only 360, well below the 6,000 cycles limit used in the fatigue crack growth analysis.

4.3.7.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of the TLAA evaluation of the reactor coolant pump motor flywheel fatigue crack growth analysis in LRA Section A.4.3.7.

On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address reactor coolant pump motor flywheel fatigue crack growth analysis is adequate.

4.3.7.4 Conclusion

On the basis of the review of the LRA, the staff concludes that the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii) that the CLB analyses for the reactor coolant pump motor flywheel fatigue crack growth analysis has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.4 Leak-Before-Break Analysis of Primary System Piping

4.4.1 Summary of Technical Information in the Application

The Leak-Before-Break (LBB) analyses for the reactor coolant system (RCS) primary piping at Three Mile Island Unit 1 (TMI-1) are contained in Topical Report BAW-1999, "TMI-1 Nuclear Power Plant Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping," April 1987 (BAW-1999), and Topical Report BAW-1847, Revision 1, "The B&W Owners Group Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSS," September 1985, (BAW-1847) that were reviewed and approved by the NRC staff for the current licensing period. The LBB analysis included fatigue flaw growth analyses, flaw stability analyses, and limit load analyses. In addition, the report qualitatively addressed thermal aging of reactor coolant pump (RCP) casings for the current period. The TLAAs for the LRA are:

(1) the fatigue flaw growth analysis
(2) the thermal aging evaluation of cast austenitic stainless steel (CASS) components

The fatigue flaw growth analyses are contained in BAW-1847, Revision 1 (and referenced in BAW-1999) and were prepared in accordance with guidance given in NUREG-1061, Volume 3. Specifically, a surface flaw was postulated at selected locations of the piping system (i.e. highest stress coincident with the lower bound of materials properties for base metal, welds, and safe ends). A fatigue crack growth analysis was performed to demonstrate that the surface flaw is likely to propagate in the through-wall direction and develop an identifiable leak before it will propagate circumferentially around the pipe to such an extent that it could cause a double-ended pipe rupture under faulted conditions. The fatigue flaw growth is based upon design transient inputs, including 240 heatup/cooldown cycles and 22 safe shutdown earthquake events, originally postulated to bound 40 years of operation. Since the number of cycles could potentially increase during the period of extended operation, the effects of aging will be managed during the period of extended operation using the Metal Fatigue of Reactor Coolant Boundary Program. The program will be used to monitor fatigue transient cycles and assure that the number of occurrences do not exceed design limits and assure that the fatigue flaw growth analysis remains valid during the period of extended operation.

Test data obtained by Argonne National Laboratory indicate that prolonged exposure of CASS to reactor coolant operating temperatures can lead to thermal aging embrittlement. The relevant aging effect is the reduction in the fracture toughness of the material as a function of time. The magnitude of the reduction depends upon the casting method (statically or centrifugally cast), material chemistry (e.g. delta ferrite and molybdenum content) and the duration of exposure at coolant operating temperature. An analysis was performed to evaluate thermal embrittlement of CASS suction and discharge nozzles for the RCP casings of the Babcock and Wilcox plants such as TMI-1. The LBB analysis was performed using material property assumptions that account for this reduction in fracture toughness properties. This analysis has been identified as a TLAA that requires evaluation for the period of extended operation.

An updated flaw stability analysis has been performed in support of a generic LBB analysis of the reactor coolant pump nozzles for ANO-1, Oconee-1, Oconee-2, Oconee-3, and TMI-1 to demonstrate that thermal embrittlement of the CASS nozzles will not prevent these components from performing their intended functions during the period of extended operation. Because this was a bounding analysis for the group of plants, the lower-bound properties of the most-susceptible material from any plant was evaluated, which was the SA-351, CF8M pump casing material applicable for ANO-1, Oconee-2, and Oconee-3. The pump casing material for TMI-1 is SA-351, CF8, which is less susceptible to thermal embrittlement. The generic analysis also assumed that each of these pump casings was fabricated from statically cast materials, which is conservative since the fracture toughness of statically-cast material is lower than that of centrifugally-cast materials.

The updated flaw stability analysis demonstrated that the CASS RCP casing materials and RCP piping meet all safety margin requirements of NRC's Standard Review Plan (SRP) 3.6.3, using the lower-bound CASS fracture toughness curves from NUREG/CR-6177, "Assessment of Thermal Embrittlement of Cast Stainless Steels," May, 1994. The most limiting material and location used in BAW-1847, Revision 1, were determined to be the base metal material of the straight section of the 28-inch cold leg pipe. Both the suction and discharge nozzles of the RCP casings are attached to the 28-inch cold leg pipes and have similar geometry and loading applied to them as the limiting location used for the LBB analysis.

4.4.2 Staff Evaluation

Pursuant to Title 10, of the *Code of Federal Regulations* (CFR), 10 CFR 54.21(c)(1)(i), the staff reviewed LRA Section 4.4 to verify that the applicant's TLAA for LBB for the RCS primary piping remain valid for the period of extended operation.

Pursuant to 10 CFR 54.21(c)(1)(iii), the staff verified that the effects of aging on the intended function of the RCS primary piping will be adequately managed for the period of extended operation. The TLAA of the LBB analyses are fatigue crack growth analyses of the subject piping and thermal aging of the CASS material of the RCS components because these two issues are time-dependent. In addition, the staff reviewed the impact of primary water stress corrosion cracking (PWSCC) and power uprate on the LBB piping.

4.4.2.1 Fatigue Crack Growth Analysis

LRA Section 4.4.1 states that the Metal Fatigue of Reactor Coolant Boundary Program will be used to monitor fatigue transient cycles to ensure that the number of transient occurrences do not exceed design limits. The staff determined that additional information was needed since it was not clear to the staff exactly how the Metal Fatigue of Reactor Coolant Boundary Program will be applied to monitor fatigue for the LBB piping. In RAI 4.4.1.0.-01, dated August 20, 2008, the staff requested that the applicant provide additional information discussing how often the

Metal Fatigue of Reactor Coolant Boundary Program monitors fatigue transient cycles, and discussing the definition of a significant thermal or pressure transient and providing the associated technical basis.

In its response to the RAI dated September 10, 2008, the applicant explained in detail that the AMP is applicable to all RCS piping and components to ensure that the number of actual plant transients do not exceed the number of transients used in the design fatigue analyses for these components. The LBB analyses are applicable only to the large-bore RCS piping and the RCPs. Therefore, these components are all within the scope of the program. The LBB analysis used the same number of design transients as the design fatigue analyses since they were derived from the same functional specifications. Therefore, the monitoring program will also ensure that the number of transient cycles experienced by the plant will be within the cycles used in the LBB analysis during the period of extended operation.

The applicant stated that when a plant transient occurs, control room operators are required to document the event in the transient cycle log if the transient meets any of the transient definitions provided in the TMI-1 fatigue monitoring procedure. They also record thermal, pressure, flow, level and/or actuation data as required for the particular transient that occurred to validate the transient type. The fatigue monitoring program engineer is required to review the transient logbook semi-annually, validate that each actual transient is bounded by the applicable design transient definition, update the cycle counts, compare actual numbers of cycles to limits, and prepare a transient summary report. The applicant will perform a corrective action when a transient is approaching 80% of its limit.

The applicant stated that transients are deemed "significant" if they affect stress cycles significantly due to the rate of change of RCS temperature and pressure during the event. Transients can be divided into two main categories: trip and non-trip. The primary difference in these two categories with regard to stress cycles is the rate of change of RCS temperatures and pressures. The reactor trips exhibit much faster changes in RCS temperature than the non-trip transients (approximately ten times faster), and are therefore monitored. Non-trip transients are also considered significant if they result in a high rate of change of core average temperature. Examples include heatups and cooldowns (450-degree change at a rate between 0.5 and 1.5 degrees per minute), Integrated Control System runbacks (up to 10-degrees per minute), and 10% step changes. For monitoring purposes, “non-significant” transients have a negligible impact on stress cycles.

Based on its review, the staff finds the applicant’s response to RAI 4.4.1.0-01 acceptable because the applicant provided adequate information concerning how often the Metal Fatigue of Reactor Coolant Boundary Program monitors fatigue transient cycles, and provided the definition of a significant thermal or pressure transient and provided the associated technical basis. The staff finds the frequency and definitions provided by the applicant acceptable. The staff’s concern described in RAI 4.4.1.0-01 is resolved.

The staff finds that the applicant has appropriate procedures to monitor transients under the program to ensure that the number of transients accumulated throughout the life of the plant including the period of extended operation is within the number of transients used in the LBB analysis.

As part of its review of the TLAA of the LBB piping, the staff questioned the scope and history of LBB piping inspection and determined that additional information was needed. In RAI 4.4.1.0-04, dated August 20, 2008, the staff requested that the applicant provide additional information and discuss the inspection history of the piping systems that have been approved for LBB, including inspection results and frequency.

In its response to the RAI dated September 10, 2008, the applicant stated that the TMI-1 LBB analyses include the 36-inch hot leg piping that connects the reactor vessel to the steam generators, the 28-inch cold leg piping that connects the steam generators to the reactor coolant pumps, and the 28-inch cold leg piping that connects the reactor coolant pumps to the reactor vessel. These components are subject to periodic examination by the ASME Section XI inservice inspection (ISI) program.

The applicant stated that the 36-inch diameter carbon steel hot leg piping includes a total of 36 Category B-J (pressure-retaining) welds (24 circumferential and 12 longitudinal). The 28-inch diameter carbon steel cold leg piping includes a total of 119 Category B-J welds (71 circumferential and 48 longitudinal) and 8 Category B-F welds (Alloy 600 welds that connect the carbon steel cold leg piping to the forged stainless steel safe ends attached to the RCP nozzles).

The applicant stated that from original plant startup in 1974 through the 2003 refueling outage, the traditional ASME B&PV Code Section XI ISI program was used. This includes all three periods of the first and second ten-year inspection intervals and the first period of the third ten-year inspection interval. The TMI-1 Inservice Inspection (ISI) Program required 100 % of the 8 Category B-F welds to be surface-examined and volumetrically examined during each ten-year inspection interval. Each of these welds was examined during each of the first two ten year inspection intervals with satisfactory results. The ISI program also required 25 % of the combined total of Category B-J and Category B-F circumferential welds to be examined in accordance with ASME Section XI or alternatives approved by the NRC during each ten-year inspection interval. The required sample of these welds was examined during the first two ten year inspection intervals with acceptable results. During the first period of the third ten-year inspection interval, additional examinations were performed for six circumferential Category B-J welds, one longitudinal Category B-J weld, and one Category B-F (Alloy 600) weld within the LBB piping. Each examination had acceptable results.

The applicant stated that beginning with the second period of the third inspection interval, the TMI-1 ISI program was changed to a risk-informed program. The NRC approved the TMI-1 Risk-Informed Inservice Inspection (RISI) Program under relief request RR-00-21 in November 2003. It was implemented for examinations in the second period of the third ten-year inspection interval, which began with the 2005 refueling outage. The RISI program characterizes the previous Category B-J and Category B-F welds as Category R-A, Medium Risk Category 4 welds. The RISI program requires examination of 10 % of the total population of the RCS Medium Risk Category 4 welds during each ten-year inspection interval. No examinations have been completed for these LBB welds under the RISI program to-date.

The applicant stated that the eight Category B-F (Alloy 600) welds are subject to minimum examination requirements from the industry guidance, MRP-139, “EPRI Materials Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guidelines (MRP-139).” The initial MRP-139 volumetric examinations are required to be completed no later than December 31, 2010. Subsequent volumetric and bare metal visual examinations are performed as specified in Tables 6-1 and 6-2 of MRP-139. Table 6-1 of MRP-139, PWSCC Category E, is appropriate for these Alloy 82/182 welds and it specifies the volumetric inspection requirement as once every 6 years. Table 6-2 of MRP-139, PWSCC Category K, specifies the frequency for visual inspections as once every three refueling outages. The TMI-1 ISI program specifies examinations of these Alloy 600 welds in accordance with these MRP-139 requirements.

Based on its review, the staff finds the applicant's response to RAI 4.4.1.0-04 acceptable because the applicant provided a discussion of the inspection history of the piping systems that have been approved for LBB, and also included the inspection results and frequency. The staff's concern described in RAI 4.4.1.0-04 is resolved.

The staff finds that the applicant has inspected the LBB piping consistently in accordance with the ASME B&PV Code, Section XI, and MRP-139. Therefore, the applicant's inspection of LBB piping and RCP is acceptable.

4.4.2.2 Thermal Embrittlement of Cast Austenitic Stainless Steel

The staff noted that the current ultrasonic testing (UT) technique has not been qualified through performance demonstration to examine CASS material in accordance with the ASME Code, Section XI. The staff determined that additional information was needed to complete its review. In RAI 4.4.2.0-02, dated August 20, 2008, the staff requested that the applicant provide additional information discussing how the RCP casing can be examined to determine its structural integrity, discussing the inspection history of the RCP casing, and discussing the inspection of the welds if the welds between the RCP nozzles and the pipe are fabricated with Alloy 82/182 filler metal.

In its response to the RAI dated September 10, 2008 the applicant stated that LRA Table 3.1.2-1 provides the Aging Management Review Results (AMRR) for the RCS, including the results for the RCP casing. One of the line items identifies loss of fracture toughness due to thermal aging embrittlement as an aging effect requiring management, and identifies the AMP as the ASME Section XI, Inservice inspection, Subsections IWB, IWC, and IWD Program. The applicant stated that the TMI-1 Inservice Inspection (ISI) Program Plan, Third Ten-Year Inspection Interval, invokes the inspection requirements from the 1995 Edition, 1996 Addenda of ASME Section XI for ASME Class 1 components. Table IWB-2500-1 of ASME Section XI categorizes pump casings as Examination Category B-L-2. Visual, VT-3 examination of the internal surface is required only when a pump is disassembled for maintenance, repair, or volumetric examination. In accordance with these requirements, Inservice Inspection Summary Table 7.1-1 of the ISI Program Plan also specifies Visual VT-3 examination of Category B-L-2 Pump Casings. The TMI-1 RCP casings do not contain Category B-L-1 welds. Therefore, no volumetric examination of the pump casings is required by ASME Section XI or by the ISI Program Plan.

The applicant stated that the TMI-1 RCS has a total of four RCPs; RC-P-1A, RC-P-1B, RC-P-1C, and RC-P-1D. Pump RC-P-1B was visually examined during the 1981 to 1984 outage in accordance with ASME Section XI requirements due to a maintenance disassembly and the results were satisfactory. Pump RC-P-1C was visually examined during the 1999 refueling outage due to a maintenance disassembly and the results were satisfactory.

The applicant stated that a forged stainless steel safe end separates each CASS RCP nozzle from the carbon steel RCS piping. A stainless steel weld joins each CASS RCP nozzle to the forged stainless steel safe end pipe. Therefore, there are no Alloy 82/182 welds joining the CASS pump casing nozzles to the pipe. The applicant noted that the RCP casings are the only CASS components within the TMI-1 RCS primary piping, and therefore the only CASS components within the scope of the LBB analysis.

Based on its review, the staff finds the applicant's response to RAI 4.4.2.0-02 acceptable because the applicant provided the additional information requested in the RAI and provided adequate discussions of how RCP casings are examined to determine their structural integrity, the inspection history of the RCP casings, and that there are no alloy 82/182 welds joining the pump casing nozzles to the pipe. The staff's concern described in RAI 4.4.2.0-02 is resolved.

By letter dated May 19, 2000, Christopher I. Grimes of the NRC forwarded to Douglas J. Walters of Nuclear Energy Institute an evaluation of thermal aging embrittlement of CASS components (ADAMS Accession ML003717179). In the NRC's May 19, 2000 letter, the staff provided its positions on how to manage CASS components. The staff determined that additional information was needed to complete its review. In RAI 4.4.1.0-03, the staff requested that the applicant provide additional information discussing how the CASS casing of the RCP satisfies the staff positions in the May 19, 2000 letter.

In its response to the RAI dated September 10, 2008, the applicant stated that the RCP casing satisfies the staff positions in the May 19, 2000 letter. The NRC evaluation in the May 19, 2000 letter states: "Valve bodies and pump casings are adequately covered by existing inspection requirements in Section XI of the ASME Code, including the alternative requirements of ASME Code Case N-481 for pump casings. Screening for susceptibility to thermal aging is not required and the current ASME Code inspection requirements are sufficient." In addition, Table 3 of the NRC evaluation specifies ASME Section XI examination requirements for CASS Pump Casings (Base Metal).

Based on its review, the staff finds the applicant's response to RAI 4.4.2.0-03 acceptable because the applicant has inspected the RCP casing consistently with the staff positions as discussed in the NRC's letter dated May 19, 2000, and, the ASME Code, Section XI. The staff's concern described in RAI 4.4.2.0-03 is resolved.

LRA Section 4.4.2 states that the lower-bound CASS material properties (e.g., fracture toughness) were used to show acceptability of CASS material for the period of extended operation. The staff determined that additional information was needed to complete its review. In RAI 4.4.2.0-05, dated August 20, 2008, the staff requested that the applicant provide additional information clarifying whether the lower-bound CASS material properties are bounding for the CASS material properties at the end of 60 years.

In its response to the RAI dated September 10, 2008, the applicant stated that the lower-bound Charpy-impact energy and fracture toughness properties for the CASS pump casings described in Section 4.4.2 of the LRA will not reduce further over time, and are therefore bounding for the CASS material properties at the end of 60 years. This is because the material property values were developed from lower-bound fracture toughness curves prepared by Framatome Technologies in accordance with NUREG/CR-6177, "Assessment of Thermal Embrittlement of Cast Stainless Steels," May 1994. NUREG/CR-6177 provides two methods for predicting Charpy-impact energy and fracture toughness values of CASS, as described below.

The applicant stated that the first method estimates the extent of thermal embrittlement at saturation, i.e., the minimum impact energy that can be achieved for the material after long-term aging, and is determined based upon actual values for the chemical composition of the steel.

The second method, which is the lower-bound method, provides an even more conservative estimate of the fracture toughness values when specific chemical composition of the CASS material is unknown. A predicted lower-bound J-R curve is developed for CASS of unknown chemical composition for a given grade of steel, ferrite content, and temperature. The lower-bound curve is based upon the worst-case material condition and also produces values that will not reduce further over time. Framatome elected to use this second method in determining the fracture toughness values described in LRA Section 4.4.2 because it is simpler and provides satisfactory results. Therefore, the analysis described in Section 4.4.2 developed predicted lower-bound fracture toughness values that are bounding for the CASS material properties at the end of 60 years.

Based on its review, the staff finds the applicant's response to RAI 4.4.2.0-05 acceptable because the applicant stated that the lower-bound Charpy-impact energy and fracture toughness properties for the CASS pump casings will not reduce further over time, and are bounding for the CASS material properties at the end of 60 years. The staff's concern described in RAI 4.4.2.0-05 is resolved.

In Section 4.4.2 of the LRA, the applicant discusses several flaw stability analyses in support of a generic LBB analysis. The staff determined that additional information was needed to complete its review. In RAI 4.4.2.0-01, dated August 20, 2008 the staff requested that the applicant provide additional information regarding the flaw stability analysis.

In its response to the RAI dated September 10, 2008, the applicant stated that there is only one flaw stability analysis as discussed in LRA Section 4.4.2. The original flaw stability analysis applicable to TMI-1 is described in BAW-1999, "TMI-1 Nuclear Power Plant Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping," April 1987. This analysis was performed in accordance with the criteria specified in NUREG-1061, Volume 3. The updated flaw stability analysis was issued in 1998 to address thermal aging of the CASS RCP casings for the period of extended operation in accordance with the criteria specified in the Standard Review Plan 3.6.3. This updated flaw stability analysis is described in Framatome Technologies Report 51-5000709-00, "Assessment of TLAA Issues in LBB Analysis of RCS Primary Piping," dated January 30, 1998. Report 51-5000709-00 is submitted as an Attachment to the September 10, 2008 letter.

The staff finds that Framatome used a conservative method to obtain the conservative fracture toughness for the CASS. The staff finds that the RCP nozzles, with consideration of thermal aging and the additional period of extended operation, meets all the safety margin criteria of SRP 3.6.3. The staff finds that thermal embrittlement of LBB piping components that are made of CASS has been considered in the design and piping components have been found to be acceptable.

Based on its review, the staff finds the applicant's response to RAI 4.4.2.0-01 acceptable because the applicant provided the needed clarification of the flaw stability analysis so the staff could complete its review. The staff's concern described in RAI 4.4.2.0-01 is resolved.

4.4.2.3 Impact of PWSCC on LBB Piping

Recent industry experience has shown that Alloy 82/182 dissimilar metal butt welds are susceptible to PWSCC in pressurized water reactors. The industry took actions to address PWSCC in butt welds when it issued MRP-139. MRP-139 provides scheduler guidance to licensees for completing initial and subsequent inspections of primary system piping butt welds originally fabricated with Alloy 82/182. The NRC staff concluded that the industry's MRP-139 inspections provided an adequate approach for ensuring integrity until ASME Code requirements for inspection of dissimilar metal butt welds are revised to provide a regulatory framework for ensuring that ASME Code-allowable limits would not be exceeded, leakage would not occur, and potential PWSCC flaws would be detected before they challenged the structural or leakage integrity of piping welds.

Code Case N-770, "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 Weld Filler Material With or Without the Application of Listed Mitigation Activities, Section XI, Division 1," was approved by ASME on January 30, 2009, and is being published in Supplement 8 of the 2007 Edition of the ASME Boiler and Pressure Vessel Code Nuclear Code Cases book. This code case was specifically written to provide inspection requirements to address potential PWSCC in Alloy 82/182 butt welds. The NRC is considering incorporating by reference the requirements of Code Case N-770 into 10 CFR 50.55a. Should the incorporation by reference occur, the inspection requirements of Code Case N-770 will supersede the inspections performed under MRP-139.

In RAI 4.4.1.0-02, dated August 20, 2008, the staff requested that the applicant provide additional information regarding (a) the actions that will be taken to mitigate and/or inspect the Alloy 82/182 welds in the LBB piping to ensure that PWSCC will not affect the structural integrity of the LBB piping, and (b) the validity of the original LBB analyses in light of industry experience in PWSCC of Alloy 82/182 butt welds.

In its response to RAI 4.4.1.0-02 dated September 10, 2008, the applicant stated that within the scope of the LBB analysis, there are a total of eight Alloy 82/182 dissimilar metal butt welds that are associated with the suction and discharge nozzles of the four RCPs. A forged stainless steel safe end is installed in each line between the CASS RCP nozzle and the carbon steel pipe. The Alloy 82/182 welds join the forged stainless steel safe end to the carbon steel RCS piping.

Currently, the Alloy 82/182 dissimilar metal welds are scheduled for examination every third refueling outage per the guidance of MRP-139. The initial MRP-139 examinations are required to be completed no later than December 31, 2010. This includes UT and bare metal visual inspection. Any future mitigation actions would be performed in accordance with the requirements of 10 CFR 50.55a and ASME Section XI. The accelerated inspection schedule of MRP-139 will continue to be followed until ASME Code Case N-770 is incorporated by reference in the regulations.

In pressurized water reactors, inspections qualified in accordance with the requirements of the ASME Code, Section XI, have found a number of indications attributed to PWSCC. However, most of these indications have been found in pressurizer piping which operates at a higher temperature than the temperature of the LBB piping at TMI. Because of its higher temperature, pressurizer piping is more susceptible to PWSCC than the LBB piping at TMI. In addition, none of the indications of PWSCC were evaluated to be structurally significant at the time of their discovery.

The staff finds that the applicant has satisfactorily addressed the impact of PWSCC on Alloy 82/182 welds in LBB piping based on operating experience and on the inspections the licensee is taking to manage the potential for PWSCC in Alloy 82/182 butt welds. In addition, if Code Case N-770 is incorporated by reference into 10 CFR 50.55a, the applicant will be required to perform the examinations specified in Code Case N-770 as conditioned in the regulations. The staff is working on a long-term generic revision of the regulatory framework for managing PWSCC. This revised framework will be based upon probabilistic fracture mechanics analyses. As a result of the ongoing study, should the NRC issue additional requirements in the future for managing degradation in LBB piping, the applicant will be required to satisfy those requirements.

4.4.2.4 Impact of Power Uprate on LBB Piping

The NRC approved a 1.3% stretch power uprate for TMI-1 on July 28, 1988 (ADAMS Accession number ML003765237). The staff determined that additional information was needed to complete its review. In RAI 4.4.1.0-03, dated August 20, 2008 the staff requested that the applicant provide additional information regarding the impact of the operating conditions of power uprates on the LBB piping at the end of 60-years.

In its response to the RAI dated September 10, 2008, the applicant stated that the LBB analyses were developed using the reactor coolant system design operating temperatures and pressures that are based upon 2568 MWt (megawatt thermal), which is both the design power level and licensed power level after the 1.3 % power uprate. Therefore, there is no impact from the 1.3% stretch power uprate on the LBB analyses.

The applicant stated that even though TMI-1 was designed for 2568 MWt, TMI-1 was initially licensed to 2335 MWt on the basis of the original design parameters for the main turbine-generator. Subsequent modifications were made to the turbine blading that resulted in significant improvements in turbine efficiency and therefore plant electrical output. As a result, the applicant requested a license amendment to increase the licensed power level to the design power level of 2568 MWt.

As discussed in the staff's safety evaluation approving the power uprate, the staff evaluated the fuel system design, the nuclear design, thermal hydraulic design, accident and transient analysis and Technical Specification changes. The staff concluded that the proposed power uprate does not change the original design conditions and that all existing reactor design and safety criteria are preserved at the higher power level of 2568 MWt. With this 1.3% stretch power uprate from 2335 MWt to 2568 MWt, TMI-1 is operating at the original design conditions. Based on the above information, the staff finds that the power uprate does not affect the LBB piping because the temperature and pressure conditions after the power uprate are the same as at the design power level.

Based on its review, the staff finds the applicant's response to RAI 4.4.1.0-03 acceptable because the applicant provided an adequate discussion of the operating conditions of the power uprate on the LBB piping at the end of 60 years. The staff's concern described in RAI 4.4.1.0-03 is resolved.

4.4.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA of the LBB analyses of primary system piping in LRA Section A.4.4. LRA Section A.4.4.1 provided the UFSAR Supplement summary description for the fatigue flaw growth analysis, and LRA Section A.4.4.2 provided the UFSAR Supplement for thermal aging embrittlement of cast austenitic stainless steel reactor coolant pump casings. On the basis of its review of the UFSAR Supplement, the staff concludes that the summary descriptions of the applicant's actions to address the TLAA for the primary system piping LBB analyses including fatigue flaw growth analysis and thermal aging embrittlement of cast austenitic stainless steel reactor coolant pump casings is adequate.

4.4.4 Conclusion

On the basis of its review of the TLAA in LRA Section 4.4, the staff concludes that pursuant to 10 CFR 54.21(c)(1)(i), the applicant has demonstrated that the LBB analyses for the RCS primary piping remain valid for the period of extended operation. Pursuant to 10 CFR 54.21(c)(1)(iii), the applicant has demonstrated that the effects of aging on the intended function of the RCS primary piping will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.5 Fuel Transfer Tube Bellows Design Cycles

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 describes the fuel transfer tube bellows and design cycles. The applicant stated that the fuel transfer tube connects the fuel transfer canal inside the primary building to the spent fuel pool located inside the fuel handling building. The fuel transfer tube passes through the primary containment wall and through the exterior wall of the fuel handling building. There are three flexible bellows in the fuel transfer system connecting the containment building to the spent fuel pool in the fuel handling building.

The fuel handling building penetration consists of a penetration sleeve through the wall, and two flexible bellows outside and inside the wall that connect the penetration sleeve to the transfer tube. The fuel transfer tube and the fuel transfer canal in the containment building are connected by a flexible bellows that performs the leakage boundary function of preventing refueling water of leaking inside containment. This bellows is not part of the primary containment pressure boundary. This function is performed by the penetration sleeve, the closure plate and the fuel transfer tube.

The bellows were designed to the ASME Code, Section VIII. Each of the three bellows was designed for a minimum of 5,000-cycles of expansion and contraction cycles for 40 years of operation. These design analyses are therefore TLAAs in accordance with 10 CFR 54.3, requiring evaluation for the period of extended operation.

To determine if the design analyses remain valid to the end of the period of extended operation, the applicant projected the number of cycles for 60 years of operation. Each refueling operation consists of one thermal cycle, which begins when the transfer canal is filled with water for refueling and ends when the canal is drained at the end of the refueling operation. Forty such refueling operations are estimated to occur in 60 years of operation, based on an 18 month interval between refueling operations. The applicant stated that this is conservative since refueling operations are now conducted every 24 months. In addition to these thermal cycles, the fuel transfer canal penetration assembly also experiences pressurization cycles during Integrated Leak Rate Tests, projected to occur once every five years, compared to a maximum interval of once every ten years. In addition, these penetrations are also assumed to be exposed to postulated 20 Safe Shutdown Earthquake cycles. The total number of cycles projected for 60 years is therefore 72 cycles.

4.5.2 Staff Evaluation

LRA Section 4.5 states that the fuel transfer tube bellows were designed for a life of 5,000-cycles. The applicant also estimated the number of cycles that the bellows will experience, projected to the end of the period of extended operation, as 72. The ASME Section VIII fatigue design criterion for bellows requires that the number of operating cycles be less than the number of design cycles. The number of 72 cycles over the life of the plant as compared to 5000 design allowable cycles meets this criterion, and is therefore acceptable. Therefore, the fuel transfer tube bellows fatigue TLAAs remain valid for the period of extended operation and have been dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

4.5.3 UFSAR Supplement

The applicant provided an UFSAR Supplement summary description of its TLAA evaluation of the fuel transfer tube bellows design cycles in LRA Section A.4.5. On the basis of its review of the UFSAR Supplement, the staff concludes that the summary description of the applicant's actions to address the fuel transfer tube bellows design cycles is adequate.

4.5.4 Conclusion

The staff has reviewed the licensee's submittal, in accordance with the GALL Report and finds that the number of cycles to which the fuel transfer bellows are designed will not be exceeded for the life of the plant. On the basis of its review, the staff concludes that the applicant has demonstrated that, pursuant to 10 CFR 54.21(c)(1)(i), the analyses of the Unit 1 fuel transfer bellows TLAA 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 Crane Load Cycle Limits

LRA Section 4.6 states that load cycle limits for cranes was identified as a potential TLAA and that the following two types of cranes are included in the scope of license renewal and have been identified as TLAA items, which require evaluation for 60 years to assure adequate structural integrity during the period of the extended operation:

(a) Reactor Building Crane (185-ton capacity)
(b) Fuel Handling Building Crane (110-ton capacity)

Since the TLAA analyses for both of these cranes are essentially identical, the staff has combined its comments and evaluations for both cranes in the following sections.

4.6.1 Summary of Technical Information in the Application

LRA Section 4.6 states that both the reactor building crane and the fuel handling building crane were designed based on the same Code, EOCI-61, "Specifications for Electric Overhead Traveling Cranes-1961," which was the design specifications for the period prior to the issuance of the Crane Manufacturers Association of America (CMAA) Specification 70. The applicant also stated that both of these cranes are compliant with the cyclic loading requirements of CMAA-70, Class A1 which states that the cranes are capable of enduring at least 20,000 lifting cycles.

The applicant further stated that the total number of lift cycles for any of the crane members will be less than 2,000-cycles over the original 40-year plant design life, as shown in a TMI-1 response (dated February 21, 1984) to NUREG-0612, “Control of Heavy Loads in Nuclear Power Plants.” The applicant concluded that both the reactor building crane and the fuel handling building crane will be safe for use during the period of extended operation.

4.6.2 Staff Evaluation

The staff reviewed LRA Section 4.6, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the analysis remains valid for the period of extended operation.

Fundamentally, the design Code, ECOI-61, which is consistent with CMAA-70 Class A1, has built in implicit fatigue analysis requiring the cranes to endure at least 20,000 lifting cycles. The projected 3,000 lifting cycles over a 60-year period is clearly well within the original design requirements. The staff finds that the applicant’s claim that the structural integrity of the reactor building crane and the fuel handling building crane will be maintained during the period of the extended operation acceptable because the projected lifting cycles are well below the crane design limit of 20,000-cycles.

During the audit, the staff asked the applicant even though there are numerous cranes and hoists listed in LRA Section 2.3.3.7, why only the reactor building crane and the fuel handling building crane were evaluated for load cycle limits. The applicant indicated that it was because other than the reactor building crane and the fuel handling building crane which were identified as TLAAs, the other cranes and hoists are being managed under the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program.

Projecting to 60 years of service, the staff finds that neither of the cranes will exceed 3,000 lifting cycles, a number well below the lower bound of the crane design life of 20,000-cycles. The staff finds the applicant’s handling of cranes and hoists aging management acceptable because it is consistent with the GALL Report Section XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.”

4.6.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of crane load cycle limits in LRA Section A.4.6. LRA Section A.4.6.1 provides the UFSAR Supplement summary description for the reactor building crane and LRA Section A.4.6.2 provides the UFSAR Supplement summary description for the fuel handling building crane. On the basis of the review of the UFSAR Supplement, the staff concludes that the summary description of the applicant’s actions to address crane load cycle limits is adequate.

4.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the load cycle limits for cranes have been projected to the end of the period of extended operation. Additionally, the staff concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7 <u>Loss of Prestress in Concrete Containment Tendons</u>

4.7.1 Summary of Technical Information in the Application

LRA Section 4.7 summarizes the evaluation of the concrete containment tendon prestress analysis for the period of extended operation. The applicant stated that the TMI-1 reactor building (containment) is a reinforced and post-tensioned concrete structure composed of a cylindrical wall with a flat foundation mat and a shallow dome roof. It is designed to American Concrete Institute (ACI) 318-63. The time dependent losses were calculated for 40 years and documented in vendor manual VM-TM-2485, as referenced in UFSAR Section 5.7.5.2.3b, which is a TLAA. The applicant also stated that the post-tensioning system consists of three groups of tendons: (1) 166 vertical tendons anchored at the top of the ring girder and the bottom of the base mat; (2) 330 hoop tendons anchored at six vertical buttresses equally spaced around the cylinder wall; and (3) 147 dome tendons that anchor at the vertical face of the ring girder. The tendons consist of 169 wires of ¼ inch diameter with a specified minimum ultimate tensile strength of 240 ksi and they are enclosed in galvanized steel conduits filled with a corrosion protection medium (grease). Tendons were initially tensioned to a force of approximately 1,400 kip.

For the TLAA, the applicant noted that the original design included a calculation of expected loss of prestress for the plant design life in accordance with ACI 318-63. The calculation evaluated loss of prestress due to elastic shortening during initial stress operations as well as time dependent losses resulting from tendon relaxation, concrete shrinkage, and concrete creep. Furthermore, the applicant noted that the TMI-1 tendon prestressing forces decrease much more rapidly in the first few years following tensioning and relatively slowly from about the 10th year on.

The TLAA AMP “Containment Program Tendon Prestress” program as described in the LRA is developed under 10 CFR 54.21(c)(1)(iii), which is part of the TMI-1 ASME Section XI, Subsection IWL Program. The TLAA AMP is based on the 1992 Edition, with 1992 Addenda, of the ASME Boiler and Pressure Vessel Code, Section XI and includes confirmatory actions that monitor loss of containment tendon prestressing forces during the current term and will continue through the period of extended operation. Assessments of the results of the tendon prestressing force measurements are performed in accordance with ASME Section XI, Subsection IWL to confirm adequacy of the prestressing forces. The applicant stated that the measured forces meet acceptance criteria specified in ASME Section XI, Sub-Section IWL, which includes (1) the force in each sample tendon is at least 95% of the force predicted for that tendon at the time of the measurement; and (2) vertical, hoop and dome sample mean forces are above the minimum required value (MRV), and regression analyses incorporating current and prior surveillance measurements show that trended vertical, hoop and dome group mean forces will not fall below the MRV prior to the deadline for completion of the subsequent surveillance.

4.7.2 Staff Evaluation

The staff reviewed LRA Section 4.7, pursuant to 10 CFR 54.21(c)(1)(iii), to verify that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Pursuant to 10 CFR 54.21(c)(1)(iii), GALL AMP X.S1 “Concrete Containment Tendon Prestress” “monitoring and trending” program element suggests that the estimated and measured prestressing forces are plotted against time and the predicted lower limit (PLL), MRV, and

trending lines developed for the period of extended operation. The staff noted that the applicant takes exception to the “acceptance criteria” element of GALL X.S1. Instead of using PLL as recommended in Regulatory Guide 1.35, TMI-1 revised its program to comply with ASME Section XI, Subsection IWL. IWL requires measured individual tendon force to be at least 95% of the predicted forces. The applicant uses the actual design basis forces as predicted forces. The staff noted that 95% of the PLL specified in Regulatory Guide 1.35.1 is less than 95% of the actual design basis forces. Therefore, the staff finds the program exception acceptable because theTMI-1 acceptance criteria are more conservative than the GALL acceptance criteria.
The staff’s evaluation of the applicant’s Concrete Containment Tendon Prestress program is documented in SER Section 3.0.3.1.26. In its review, the staff noted that the plots or data for the historically inspected tendon forces, predicted forces, trend lines, and minimum required values (MRV) were not presented in the applicant’s LRA. In RAI 4.7-1, dated September 30, 2008, the staff requested that the applicant provide additional information regarding the log-year graphs of individual tendon forces versus 95% of the predicted force, and also provide trend lines against MRV to confirm the adequacy of the prestressing forces.

In its response to the RAI dated October 23, 2008, the applicant provided six graphs to demonstrate the adequacy of the prestressing forces of TMI-1 concrete containment tendons. The first three graphs illustrate the individual measured tendon forces and MRV for each tendon group for vertical, hoop and dome. These graphs also indicate the measured tendon force trend lines and 95% lower confidence limit (LCL) projected through the period of extended operation. The other three graphs illustrate the measured control tendon forces and MRV for each control tendon. Also indicated are the measured control tendon force trend lines and predicted force trend lines for each control tendon projected through the period of extended operation.
In the same response, the applicant further stated that the third paragraph in the “Analysis” portion of LRA Section 4.7 should have included the acceptance criteria per ASME Section XI, Subsection IWL, paragraphs IWL-3221.1(b)(1), (2) and (3). As a result, the applicant revised the paragraph to reflect this inclusion.

Based on its review, the staff finds the applicant’s response to RAI 4.7-1 acceptable because the Acceptance Standards per ASME Section XI, Subsection IWL, Article IWL-3000 are followed. The graphs provided by the applicant have confirmed the adequacy of the prestressing forces. Therefore, the staff’s concern described in RAI 4.7-1 is resolved.
The staff reviewed LRA Section 4.7, and the relevant references cited in the TLAA, and finds that the applicant has adequate procedures in place for monitoring and trending the containment prestressing forces. The staff also finds that the applicant’s choice to manage this TLAA pursuant to 10 CFR 54.21(c)(1)(iii) is acceptable. The staff, therefore, concludes that in conjunction with the Containment Program Tendon Prestress Program, the prestressing tendon forces in containment will be adequately managed.

4.7.3 UFSAR Supplement

The applicant provided an UFSAR Supplement summary description of its TLAA evaluation of the concrete containment tendon prestress analysis in LRA Section A.4.7. On the basis of its review of the UFSAR Supplement, the staff concludes that the summary description of the applicant’s actions to address the concrete containment tendon prestress analysis is adequate.

4.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for the concrete containment tendon prestress analysis, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation in conjunction with the AMP which was developed by the applicant for this TLAA under 10 CFR 54.21(c)(1)(iii) in order to ensure the adequacy of prestressing forces in prestressed concrete containment tendons during 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 Environmental Qualification of Electrical Equipment

The 10 CFR 50.49 EQ program is a TLAA for purposes of license renewal. The TLAA of the environmental qualification (EQ) of electrical components includes all long-lived, passive, and active electrical and I&C components that are important to safety and are located in a harsh environment. The harsh environments of the plant are those areas subject to environmental effects by loss-of-coolant accidents or high-energy line breaks. EQ equipment comprises safety-related and Q-list equipment, nonsafety-related equipment the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs. The applicant shall demonstrate that for each type of EQ equipment, one of the following is true: (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.8.1 Summary of Technical Information in the Application

LRA Section 4.8 summarizes the evaluation of EQ of electrical equipment for the period of extended operation. The applicant stated that the EQ program is in compliance with the requirements of 10 CFR 50.49, and is being used to manage the aging of equipment in the EQ program during the current license term. The existing EQ program will be used to manage aging of equipment in the EQ program during the period of extended operation and includes provision to ensure that the qualification bases are maintained and the components do not exceed their qualified lives.

4.8.2 Staff Evaluation

The staff reviewed LRA Section 4.8 to confirm that pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff reviewed Section 4.8 of the LRA and plant basis documents to determine whether the applicant provided adequate information to meet the requirements of 10 CFR 54.21(c)(1). For the electrical equipments identified in the EQ master list, the applicant used 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that the aging effects of EQ equipment will be adequately managed during the period of extended operation. The staff reviewed the EQ program to confirm whether it will assure that 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 to meet the requirements delineated in 10 CFR 50.49.

The staff conducted an audit of the information provided in LRA Section B.3.1.3 and program basis documents. On the basis of its audit, the staff finds that the EQ program, which the applicant claimed to be consistent with GALL AMP X.E1, "Environment Qualification of Electrical Components," is consistent. The staff finds that the EQ program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal and that the continued implementation of the EQ program provides assurance that the aging effects will be managed and that components within the scope of the EQ program will continue to perform their intended functions for the period of extended operation.

4.8.3 UFSAR Supplement

The applicant provided a UFSAR Supplement summary description of its TLAA evaluation of environmental qualification of electrical equipment in LRA Section A.3.1.3. On the basis of its review of the UFSAR Supplement, the staff has determined that the summary description of the applicant's actions to address environmental qualification of electrical equipment is adequate.

4.8.4 Conclusion

The staff concludes that the applicant has demonstrated that, for EQ of electrical equipment, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(iii). The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.9 Conclusion

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 an adequate list of TLAAs, as defined in 10 CFR 54.3. Further, the staff concludes that the applicant demonstrated that: (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) that the aging effects 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 found that the UFSAR Supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes that one plant-specific exemption is in effect that is based on TLAAs, and that the applicant has provided an adequate evaluation that justifies the continuation of this exemption for the period of extended operation as required by 10 CFR 54.21(c)(2).

With regard to these matters, the staff concludes that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the CLB, in order to comply with 10 CFR 54.21(c), are in accordance with the Atomic Energy Act of 1954 and the NRC's regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), the full Advisory Committee on Reactor Safeguards (ACRS) will review the license renewal application (LRA) for the Three Mile Island Nuclear Station, Unit 1 (TMI-1). After the full review, the ACRS Subcommittee on Plant License Renewal will continue its review of the LRA after the safety evaluation report (SER) is issued. The applicant and the staff of the U.S. Nuclear Regulatory Commission (the staff) will meet with the ACRS subcommittee and the full committee to discuss the LRA review.

After the ACRS Subcommittee completes its review of the TMI-1 LRA and SER, the full committee will issue a report discussing the results of the review. The SER will be updated to include the ACRS report and the staff's response to issues and concerns identified in the ACRS report.

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SECTION 6

CONCLUSION

The staff of the U.S. Nuclear Regulatory Commission (the staff), reviewed the license renewal application (LRA) for the Three Mile Island Nuclear Station, Unit 1 (TMI-1), in accordance with the NRC regulations and NUREG-1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” dated September 2005. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) provides the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff concludes that the requirements of 10 CFR 54.29(a) have been met.

The staff notes that any requirements of Subpart A of 10 CFR Part 51 are documented in Supplement 37 to NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Three Mile Island Nuclear Station, Unit-1 Final Report,” dated June 2009.

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APPENDIX A

Commitments For License Renewal Of TMI-1

During the review of the Three Mile Island Nuclear Station, Unit 1 (TMI-1), license renewal application (LRA) by the staff of the U.S. Nuclear Regulatory Commission (staff), Amergen Energy Company, LLC (Amergen) the applicant, made commitments related to aging management programs (AMPs) to manage aging effects of structures and components (SCs) prior to the period of extended operation. The following table lists these commitments, along with the implementation schedules and the sources of the commitment.

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
1	The ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program is being implemented.	Ongoing	January 08, 2008 Letter
2	The Water Chemistry Program will be enhanced to incorporate the continuous monitoring of sodium in steam generator blowdown, making it consistent with EPRI 1008224, Pressurized Water Reactor Secondary Water Chemistry Guidelines, Revision 6.	Prior to the period of extended operation	January 08, 2008 Letter
3	The Reactor Head Closure Studs Program is being implemented. The program will be enhanced to select an alternate stable lubricant that is compatible with the fastener material and the environment.	Prior to the period of extended operation	January 08, 2008 Letter October 30, 3008 Letter
4	The Boric Acid Corrosion Program is being implemented.	Ongoing	January 08, 2008 Letter
5	Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	Ongoing	January 08, 2008 Letter
6	The Flow-Accelerated Corrosion Program is being implemented.	Ongoing	January 08, 2008 Letter
7	The Bolting Integrity Program is being implemented.	Ongoing	January 08, 2008 Letter
8	The Steam Generator Tube Integrity Program is being implemented.	Ongoing	January 08, 2008 Letter
9	The Open-Cycle Cooling Water Program will be enhanced by adding a new river water chemical system to treat the river water systems for biofouling.	Prior to the period of extended operation	January 08, 2008 Letter
10.	The Closed-Cycle Cooling Water Program will be enhanced to include a one-time inspection of selected components in stagnant flow areas to confirm the absence of aging effects resulting from exposure to closed cycle cooling water. Also, a one-time inspection of selected CCCW chemical mix tanks and associated piping components will be performed to verify corrosion has not occurred on the interior surfaces of the tanks and associated piping components.	Program and one-time inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
11.	The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be enhanced to include visual inspection of rails in the rail system for loss of material due to wear, and visual inspection of structural bolting for loss of material. Acceptance criteria will be enhanced to require that significant loss of material due to wear will be evaluated or corrected to ensure the intended function of the crane or hoist is not impacted.	Prior to the period of extended operation	January 08, 2008 Letter
12.	The Compressed Air Monitoring Program will be enhanced to include air quality testing for dew point, particulates, lubricant content, and contaminants to ensure that the contamination standards of ANSI/ISAS7.0.01-1996, paragraph 5 are met. In addition the program will be enhanced to include air quality sampling on a representative sampling of headers on a yearly basis in accordance with the guidelines of ASME OM-S/G-1998, Part 17 and EPRI TR-108147.	Prior to the period of extended operation	January 08, 2008 Letter
13.	The Fire Protection Program will be enhanced to include additional inspection criteria for degradation of fire barrier walls, ceilings, and floors, and specific fuel supply line inspection criteria for diesel driven fire pumps during tests. In addition, implementing surveillance procedures for halon and carbon dioxide suppression systems will specifically require inspection for corrosion, mechanical damage, or damage to dampers, and will include acceptance criteria stating that detected signs of corrosion or mechanical damage be evaluated, with corrective action taken as appropriate.	Prior to the period of extended operation	January 08, 2008 Letter October 20, 2008 Letter
14.	The Fire Water System Program will be enhanced to include sprinkler head testing in accordance with NFPA 25, "Inspection, Testing and Maintenance of Water-Based Fire Protection Systems." Samples will be submitted to a testing laboratory prior to being in service 50 years. This testing will be repeated at intervals not exceeding 10 years. Prior to the period of extended operation, the program will be enhanced to include periodic non-intrusive wall thickness measurements of selected portions of the fire water system at an interval not to exceed every 10 years. The initial wall thickness inspections will be performed prior to the period of extended operation.	Prior to the period of extended operation, and Inspection schedule identified in commitment	January 08, 2008 Letter May 29, 2009 Letter
15.	The Aboveground Steel Tanks Program will be enhanced to include one-time thickness measurements of the bottom of the Condensate Storage Tanks, which are supported on concrete foundations. The measurements will be taken to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. The program will also be enhanced to inspect the sealant at the tank-foundation interface.	Program and one-time inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
16.	The Fuel Oil Chemistry Program will be enhanced to include: 1. The analysis of new fuel oil for specific or API gravity, kinematic viscosity, and water and sediment prior to filling the fuel oil storage tanks followed by full spectrum analysis within 31 days after the addition of the fuel oil into the fuel oil storage tanks. 2. The determination of water and sediment and particulate contamination in accordance with ASTM standards. 3. The analysis for bacteria in new and stored fuel oil. 4. The addition of biocides, stabilizers, or corrosion inhibitors as determined by fuel oil analysis activities. 5. Activities to periodically drain water and sediment from tank bottoms, and, activities to periodically drain, clean, and inspect fuel oil tanks. 6. Manual sampling in accordance with ASTM standards and required frequencies. 7 The use of ultrasonic techniques for determining tank bottom thicknesses should there be any evidence of loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling found during visual inspection activities. 8. To confirm the absence of any significant aging effects, one-time inspections will be performed on the following tanks: A. Station Blackout Diesel Clean Fuel Tank. 2. Station Blackout Diesel Day Tank.	Program and one-time inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter
17.	The Reactor Vessel Surveillance Program will be enhanced to address maintenance of the TMI-1 cavity dosimetry exchange schedule. The program will also be enhanced to clarify that, if future plant operations exceed the limitations or bounds specified in Regulatory Position 1.3 of RG 1.99, Rev. 2, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified.	Prior to the period of extended operation	January 08, 2008 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
18.	The One-Time Inspection Program used to provide reasonable assurance that an aging effect is not occurring, or that the aging effect is occurring slowly enough to not affect a components intended function during the period of extended operation, and therefore will not require additional aging management. The program will be credited for cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected, or (c) the characteristics of the aging effect include a long incubation period. This program will be used for the following: 1. To confirm the effectiveness of the Water Chemistry program to manage the loss of material, cracking, and the reduction of heat transfer aging effects for steel, stainless steel, copper alloy, nickel alloy, and aluminum alloy in treated water, steam, and reactor coolant environments. 2. To confirm the effectiveness of the Fuel Oil Chemistry program to manage the loss of material aging effect for steel, stainless steel, and copper alloy in a fuel oil environment. 3. To confirm the effectiveness of the Lubricating Oil Analysis program to manage the loss of material and the reduction of heat transfer aging effects for steel, stainless steel, copper alloy, and aluminum alloy in a lubricating oil environment. 4. To confirm the loss of material aging effect is insignificant for stainless steel and copper alloy in an air/gas – wetted environment. Inspection methods will include visual examination or volumetric examinations. Acceptance criteria will be in accordance with industry guidelines, codes, and standards. The One-Time Inspection program provides for the evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation. Should aging effects be detected, the program triggers actions to characterize the nature and extent of the aging effect and determines what subsequent monitoring is needed to ensure intended functions are maintained during the period of extended operation.	Program and one-time inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter
19.	The Selective Leaching of Materials Program will be used to manage the loss of material due to selective leaching. The program includes inspection of a representative sample of susceptible components to determine if loss of material due to selective leaching is occurring. One-time inspections will include visual examinations, supplemented by hardness tests, and other examinations, as required. If selective leaching is found, the condition will be evaluated to determine the need to expand inspection scope.	Program and one-time inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
20.	The Buried Piping and Tanks Inspection Program will be enhanced to include: 1. Inspection of buried stainless steel piping and components prior to entering the period of extended operation. 2. Inspection of buried cast iron, carbon steel, concrete-coated carbon steel, and stainless steel piping and components within ten years after entering the period of extended operation. 3. Internal inspection and UT of the D.G. Fuel Storage 30,000 Gallon Tank prior to the period of extended operation, and within ten years after entering the period of extended operation	Prior to the period of extended operation, Inspection schedule identified in commitment	January 08, 2008 Letter May 29, 2009 Letter
21.	The External Surfaces Monitoring Program will be used to manage aging effects through visual inspection of external surfaces for evidence of hardening and loss of strength and loss of material. The program directs visual inspections that are performed during system walkdowns. The program consists of periodic visual inspection of components such as piping, piping components, ducting, and other components within the scope of license renewal. Visual inspections may be augmented by physical manipulation to detect hardening and loss of strength of elastomers.	Prior to the period of extended operation	January 08, 2008 Letter
22.	The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be used to manage cracking due to stress corrosion cracking; hardening and loss of strength due to elastomer degradation; loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling; and reduction of heat transfer due to fouling. The program includes provisions for visual inspections of the internal surfaces and volumetric testing of components not managed under any other aging management program. Visual inspections may be augmented by physical manipulation to detect hardening and loss of strength of elastomers.	Prior to the period of extended operation	January 08, 2008 Letter October 20, 2008 Letter
23.	The Lubricating Oil Analysis Program is being implemented.	Ongoing	January 08, 2008 Letter
24.	The ASME Section XI, Subsection IWE Program is being implemented.	Ongoing	January 08, 2008 Letter
25.	The ASME Section XI, Subsection IWL Program is being implemented.	Ongoing	January 08, 2008 Letter
26.	The ASME Section XI, Subsection IWF Program is being implemented.	Ongoing	January 08, 2008 Letter
27.	The 10 CFR Part 50, Appendix J Program is being implemented.	Ongoing	January 08, 2008 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
28.	Existing program is credited. The program will be enhanced to include: 1. Service Building. 2. UPS Diesel Building. 3. Mechanical Draft Cooling Tower Structure. 4. Miscellaneous Yard Structures: Storm Drainage and Flood Control Structure, including the structural platform; Duct banks; Manholes; Foundations for Condensate Storage Tank, Borated Water Storage Tank including the Borated Water Storage Tank tunnel, Altitude Tank, Emergency Diesel Fuel Oil Storage Tank. 5. Penetration seals which perform a license renewal intended function for an in-scope structure. 6. Monitoring of the intake canal for loss of material and loss of form. 7. Monitoring of electrical panels, junction boxes, instrument panels, and conduits for loss of material due to corrosion. 8. Monitoring of ground water chemistry by periodically sampling, testing, and analysis of ground water to confirm that the environment remains non-aggressive for buried reinforced concrete. 9. Monitoring of reinforced concrete submerged in raw water associated with intake screen and pumphouse, circulating water pump house, mechanical draft cooling tower structures, natural draft cooling tower basins, and circulating water tunnel. 10. Monitoring of vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF, for reduction or loss of isolation function. 11. Monitoring of HVAC duct supports for loss of material. 12. Parameters monitored will be enhanced to include plausible aging effects and mechanisms. 13. Monitoring of concrete structures for a reduction in anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking, and spalling. 14. Revised acceptance criteria to provide details specified in ACI 349.3R-96.	Prior to the period of extended operation	January 08, 2008 Letter August 19, 2008 Letter May 29, 2009 Letter
29.	The Protective Coating Monitoring and Maintenance Program is being implemented.	Ongoing	January 08, 2008 Letter
30.	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will be used to manage aging of non-EQ cables and connections during the period of extended operation. A representative sample of accessible cables and connections located in adverse localized environments will be visually inspected at least once every 10 years for indications of accelerated insulation aging such as embrittlement, discoloration, cracking, or surface contamination. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable or connection.	Program and first inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
31.	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will be enhanced to manage the aging of the cable and connection insulation of the in scope radiation monitoring and nuclear instrumentation circuits in the Radiation Monitoring and Nuclear Instrumentation and Incore Monitoring Systems. The in scope radiation monitoring and nuclear instrumentation circuits are sensitive instrumentation circuits with low-level signals and are located in areas where the cables and connections could be exposed to adverse localized environments caused by heat, radiation, or moisture. These adverse localized environments can result in reduced insulation resistance causing increases in leakage currents. Calibration testing and performance monitoring are currently being performed for in scope radiation monitoring circuits. Direct cable testing will be performed as an enhancement to ensure that the cable and connection insulation resistance is adequate for the nuclear instrumentation circuits to perform their intended functions.	Program, first tests and calibrations, and first assessment of calibration results to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter
32.	The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements will be used to manage the aging effects and mechanisms of non-EQ, in scope inaccessible medium voltage cables. These cables may at times be exposed to significant moisture simultaneously with significant voltage. The TMI-1 cables in the scope of this aging management program will be tested using a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. The cables will be tested at least once every 10 years. Manholes associated with the cables included in this aging management program will be inspected for water collection initially at least twice a year, in accordance with existing practices, and drained as required. The frequency will be adjusted based on inspection results recognizing that the objective of the inspections, as a preventive action, is to keep the cables infrequently submerged, thereby minimizing their exposure to significant moisture. The maximum time between inspections will be two years, which is in alignment with the recommended frequency in NUREG-1801, AMP XI.E3.	Program and first tests and inspections to be implemented prior to the period of extended operation	January 08, 2008 Letter October 30, 2008 Letter May 29, 2009 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
33.	The Metal Enclosed Bus Program will be enhanced to include the following inspection criteria: 1. The internal portion of the metal enclosed bus will be visually inspected for cracks, corrosion, foreign debris, excessive dust build-up and evidence of moisture intrusion. 2. The bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. 3. The internal bus supports will be visually inspected for structural integrity and signs of cracks. The program will also be enhanced to perform internal visual inspections on the 480V Metal Enclosed Bus and the Station Black Out Metal Enclosed Bus.	Program and first inspections and tests to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 letter
34.	The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will be used to manage the aging effects of metallic parts of non-EQ electrical cable connections within the scope of license renewal during the period of extended operation. A representative sample of non-EQ electrical cable connections will be selected for one-time testing considering application (medium and low voltage), circuit loading (high loading) and location, with respect to connection stressors. The technical basis for the sample selected is to be documented. The specific type of test performed will be a proven test for detecting loose connections, such as thermography or contact resistance measurement, as appropriate to the application.	Program and one-time testing to be implemented prior to the period of extended operation	January 08, 2008 Letter May 29, 2009 Letter
35.	The Nickel Alloy Aging Management Program will implement applicable Bulletins, Generic Letters, and staff-accepted industry guidelines.	Ongoing	January 08, 2008 Letter
36.	The PWR Vessel Internals Program will commit to the following activities: 1. Participate in the industry programs for investigating and managing aging effects on reactor internals. 2. Evaluate and implement the results of the industry programs as applicable to the reactor internals. 3. Upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	Prior to the period of extended operation	January 08, 2008 Letter
37.	The Metal Fatigue of Reactor Coolant Pressure Boundary Program will be enhanced to add the statement: “Acceptable corrective actions include: reanalysis of the component to demonstrate that the design code limit will not be exceeded prior to or during the period of extended operation; repair of the component; replacement of the component, or other methods approved by the NRC.” In addition, the program will be enhanced to require a review of additional reactor coolant pressure boundary locations if the usage factor for one of the environmental fatigue sample locations approaches its design limit.	Prior to the period of extended operation	January 08, 2008 Letter
38.	The Concrete Containment Tendon Prestress Program is being implemented.	Ongoing	January 08, 2008 Letter

APPENDIX A: LONG TERM COMMITMENTS FOR LICENSE RENEWAL OF TMI-1			
No.	**Commitment**	**Implementation Schedule**	**Source**
39.	The Environmental Qualification of Electrical Components program is being implemented.	Ongoing	January 08, 2008 Letter
40.	New Once Through Steam Generators will be installed.	Prior to the period of extended operation	January 08, 2008 Letter
41.	Revised pressure-temperature (P-T) limits and low-temperature overpressurization (LTOP) limits for a 60-year operating life have been prepared and will be submitted to the NRC for approval.	Prior to the period of extended operation or prior to exceeding 29 EFPY, whichever comes first	LRA Section 4.2.5
42.	Prior to the period of extended operation, TMI-1 will restore the reactor building liner to its nominal plate thickness by weld repair for the previously identified corroded areas of the reactor building liner where the thickness of the base metal is reduced by more than 10% of the nominal plate thickness.	Prior to the period of extended operation	October 30, 2008 Letter
43.	Boral test coupon surveillance will continue through the period of extended operation	Ongoing	November 12, 2008 Letter

APPENDIX B

Chronology

This Appendix contains a chronological listing of the routine correspondence between the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) and the Amergen Energy Company, LLC (Amergen or the applicant), and other correspondence regarding the staff's reviews of the Three Mile Island Nuclear Station, Unit 1 (TMI-1), Docket Number 50-289, license renewal application (LRA).

January 03, 2008	Three Mile Island Nuclear Station, Unit 1, Thirty-Three License Renewal Drawings. (Accession No. ML080220572)
January 03, 2008	Three Mile Island Nuclear Station, Unit 1, Thirty-Nine License Renewal Drawings. (Accession No. ML080220570)
January 03, 2008	Three Mile Island Nuclear Station, Unit 1, Forty License Renewal Drawings. (Accession No. ML080220569)
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APPENDIX C

Principal Contributors

Name	Responsibility
R. Auluck	Management Oversight
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T. Chan	Management Oversight
M. Cunningham	Management Oversight
J. Daily	Project Management
J. Dozier	Management Oversight
G. Cranston	Management Oversight
J. Davis	Management Oversight
R. Denning	Management Oversight
K. Desai	Reviewer—Mechanical
M. Evans	Management Oversight
C. Fairbanks	Reviewer—Mechanical
F. Farzam	Reviewer—Structures
S. Gardocki	Reviewer—Mechanical
M. Hartzman	Reviewer—Mechanical Engineering
M. Gavrilas	Management Oversight
D. Harrison	Management Oversight
P. Hiland	Management Oversight
A. Hiser	Management Oversight
D. Hoang	Reviewer—Structural
B. Holian	Management Oversight
N. Iqbal	Reviewer—Fire Protection

Name	Responsibility
M. Khana	Management Oversight
A. Klein	Management Oversight
S. Lee	Management Oversight
R. Li	Reviewer—Electrical
L. Lois	Reviewer—Mechanical
S. Lopas	Project Management
J. Lubinski	Management Oversight
L. Lund	Management Oversight
K. Manoly	Management Oversight
R. Mathew	Management Oversight
K. Miller	Reviewer—Electrical
M. Mitchell	Management Oversight
D. Nguyen	Reviewer—Electrical
B. Pham	Management Oversight
D. Pelton	Management Oversight
G. Purciarello	Management Oversight
J. Raval	Reviewer—Mechanical
J. Robinson	Project Management
B. Rogers	Project Management
W. Ruland	Management Oversight
A. Sallman	Reviewer – Mechanical
R. Sun	Reviewer—Mechanical
B. Titus	Reviewer—Structures
J. Tsao	Reviewer—Mechanical
G. Wilson	Management Oversight
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Name	Responsibility
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O. Yee	Mechanical Engineering
Z. Xi	Structural Engineering

Contractor	Technical Area
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Advanced Technologies and Laboratories, Inc.	Plant Systems/GALL Audit

APPENDIX D

References

This appendix contains a listing of the references used in the preparation of the Safety Evaluation Report (SER) prepared during the review of the license renewal application (LRA) for Three Mile Island Nuclear Station, Unit 1 (TMI-1), Docket Number 50-289.

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