Safety Evaluation Report

Related to the License Renewal of Davis-Besse Nuclear Power Station

Docket Number 50-346

FirstEnergy Nuclear Operating Company

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
September 2013

ABSTRACT

This safety evaluation report (SER) documents the technical review of the Davis-Besse Nuclear Power Station (Davis-Besse) license renewal application (LRA) by the U.S. Nuclear Regulatory Commission (NRC or the staff). By letter dated August 27, 2010, FirstEnergy Nuclear Operating Company (FENOC 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.” FENOC requests renewal of Davis-Besse operating license (Facility Operating License Number NPF-3) for a period of 20 years beyond the current license date of April 22, 2017.

Davis-Besse is located approximately 20 miles east of Toledo, Ohio. The NRC issued the construction permit on March 24, 1971. The NRC issued the operating license on April 22, 1977. The unit is a pressurized-water reactor design with a dry ambient containment. Babcock and Wilcox Corporation supplied the nuclear steam supply system, and Bechtel designed and constructed the balance of the plant. The licensed power output of the unit is 2,817 megawatt thermal with a gross electrical output of approximately 908 megawatt electric.

This SER presents the status of the staff’s review of information submitted through June 4, 2013, the cutoff date for consideration in the SER. The staff has resolved all issues associated with requests for additional information and closed all open items since publishing the SER with Open Items. The staff did not identify any new open items that must be resolved before any final determination can be made on the LRA.

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ABBREVIATIONS

AC	alternating current
ACAR	aluminum core alloy reinforced
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum core steel reinforced
ADAMS	Agencywide Document Access and Management System
AERM	aging effect requiring management
AFW	auxiliary feedwater
ALARA	as low as is reasonable achievable
AMP	aging management program
AMR	aging management review
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOTC	allowable operating transient cycles
APCSB	Auxiliary and Power Conversion Systems Branch
ART	adjusted reference temperature
ARTS	anticipatory reactor trip system
ASCE	American Society of Civil Engineers
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWWA	American Water Works Association
B&W	Babcock and Wilcox
B&WOG	Babcock and Wilcox Owners Group
B-10	Boron-10
BAA	boric acid addition
BTP	branch technical position
BWR	boiling water reactor
BWST	borated water storage tank
C	Celsius
CAL	confirmatory action letter number
CASS	cast austenitic stainless steel
CCW	component cooling water
CEA	control element assembly

CF	chemistry factor
CFR	U.S. Code of Federal Regulations
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CMTR	certified material test report
CR	condition report
CRD	control rod drive
CRGT	control rod guide tube
CSA	core support assembly
CSS	core support shield
CST	condensate storage tank
Cu	copper
CUF	cumulative usage factor
CUF_{en}	environmentally-assisted fatigue cumulative usage factor
Davis-Besse	Davis-Besse Nuclear Power Station
DBA	design-basis accident
DBE	design-basis event
DG	diesel generator
DHR	decay heat removal
DLR	Division of License Renewal
DMW	dissimilar metal weld
DWS	demineralized water storage
EAF	environmentally-assisted fatigue
ECCS	emergency core cooling system
ECP	engineering change package
EDG	emergency diesel generator
EFPY	effective full power year
EMA	equivalent margins analysis
EPDM	ethylene-propylene-diene
EPRI	Electrical Power Research Institute
EQ	environmental qualification
ESF	engineered safety features
ESOMS	shift operations management system
F	Fahrenheit
F_{en}	environmentally-assisted fatigue correction factor
FENOC	FirstEnergy Nuclear Operating Company
FERC	Federal Energy Regulatory Commission
FHAR	fire hazards analysis report

FIV	flow-induced vibration
FR	Federal Register
FSAR	final safety analysis report
ft	foot
ft-lb	foot-pound
g/cm^2	grams per square centimeter
GALL	generic aging lessons learned
GCR	general corrosion rate
GEIS	generic environmental impact statement
GL	generic letter
HAZ	heat-affected zone
HELB	high-energy line break
HPI	high-pressure injection
HPSI	high-pressure safety injection
HU/CD	heatup and cooldown
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and control
IASCC	irradiation-assisted stress corrosion cracking
IGA	intergranular attack
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leak rate tests
IMI	incore monitoring instrumentation
IN	information notice
in.	inch
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISA	Instrument Society of America
ISG	interim staff guidance
ISI	inservice inspection
ksi	kips per square inch
kV	kilovolt
LBB	leak-before-break
LCO	limiting condition for operation
LER	licensee event report
LOCA	loss-of-coolant accident
LPI	low-pressure injection

LRA	license renewal application
LTOP	low-temperature overpressure protection
LWR	light-water reactor
M	margin term
MDFP	motor-driven feedwater pump
MEB	metal-enclosed bus
MeV	megaelectron volt
MFW	main feedwater
mg/l	milligrams per liter
mi	mile
MIC	microbiologically-influenced corrosion
MIRVP	Master Integrated Reactor Vessel Program
MIRVSP	Master Integrated Reactor Vessel Surveillance Program
MoS^2	molybdenum disulfide
MRP	Materials Reliability Program
MRPM	Maintenance Rule Program Manual
MUR	measurement uncertainty recapture
MWe	megawatt electric
MWt	megawatt thermal
MWT	Makeup Water Treatment
n/cm^2	Newton per square centimeter
NACE	National Association of Corrosion Engineers
NDE	nondestructive examination
NDT	nondestructive testing
NEI	Nuclear Energy Institute
NEPA	National Environmental Protection Agency
NFPA	National Fire Protection Association
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NSSS	nuclear steam supply system
OE	operating experience
OEM	original equipment manufacturer
OI	open item
OPA	Office of Public Affairs
OTSG	once-through steam generator
P&ID	piping and instrumentation diagram
PM	preventive maintenance

PORV	pilot-operated relief valve
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
P-T	pressure-temperature
PTLR	pressure-temperature limits report
PTS	pressurized thermal shock
PWR	pressurized-water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
QAPM	Quality Assurance Program Manual
RAI	request for additional information
RCCA	rod cluster control assembly
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RCSC	Research Council for Structural Connections
RFO	refueling outage
RG	regulatory guide
RIS	regulatory issue summary
RP	regulatory position
RPV	reactor pressure vessel
RT	radiological testing
RT_{NDT}	nil-ductility reference temperature
RT_{PTS}	reference temperature for pressurized thermal shock
RV	reactor vessel
RVI	reactor vessel internals
RVID	Reactor Vessel Integrity Database
SBO	station blackout
SBODG	station blackout diesel generator
SC	structure and component
SCC	stress corrosion cracking
SE	safety evaluation
SER	safety evaluation report
SFP	spent fuel pool
SG	steam generator

SOC	statement of consideration
SOER	supplemental operating experience report
SRP	Standard Review Plan
SRP-LR	standard review plan-license renewal
SSC	system, structure, and component
SUFP	startup feed pump
TLAA	time-limited aging analysis
TPCW	turbine plant cooling water
TR	technical report
TS	technical specifications
U_{en}	environmentally-adjusted cumulative usage factor
UFSAR	updated final safety analysis report
USACE	U.S. Army Corps of Engineers
USAR	updated safety analysis report
USE	upper-shelf energy
UT	ultrasonic thickness
V	volt
Zn	zinc

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Davis-Besse Nuclear Power Station (Davis-Besse), as filed by FirstEnergy Nuclear Operating Company (FENOC or the applicant). By letter dated August 27, 2010, FENOC submitted its application to the U.S. Nuclear Regulatory Commission (NRC or the staff) for renewal of the Davis-Besse operating license for an additional 20 years. The NRC prepared this report to summarize the results of its safety review of the LRA for compliance with Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 54). The NRC project manager for the license renewal review is Samuel Cuadrado de Jesús. Mr. Cuadrado de Jesús may be contacted by telephone at 301-415-2946, or by electronic mail at samuel.cuadradodejesus@nrc.gov. Alternatively, written correspondence may be sent to the following address:

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In its August 27, 2010, submission letter, the applicant requested renewal of the operating license, issued under Section 103 (Operating License No. NPF-3) of the Atomic Energy Act of 1954, as amended, for a period of 20 years beyond the current license date of April 22, 2017. Davis-Besse is located approximately 20 miles east of Toledo, OH. The NRC issued the construction permit on March 24, 1971. The NRC issued the operating license on April 22, 1977. The unit is a pressurized-water reactor (PWR) design with a dry ambient containment. The nuclear steam supply system (NSSS) was furnished by the Babcock & Wilcox Company, and Bechtel Corporation, its affiliate, designed and constructed the balance of the plant. The licensed power output of the unit is 2,817 megawatt thermal (MWt) with a gross electrical output of approximately 908 megawatt electric (MWe). The updated safety analysis report (USAR) shows details of the plant and the site.

The license renewal process consists of two concurrent reviews, a technical review of safety issues, and an environmental review. The NRC regulations in 10 CFR Part 54 and 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," respectively, set forth requirements for these reviews. The safety review for the Davis-Besse license renewal is based on the applicant's LRA and on its responses to the staff's requests for additional information (RAIs). The applicant supplemented the LRA and provided clarifications through its responses to the staff's RAIs in audits, meetings, and docketed correspondence. Unless otherwise noted, the staff reviewed and considered information submitted through June 4, 2013. The staff may consider information received after that date depending on the progress 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 USAR, at the NRC Public Document Room, located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, MD, 20852-2738 (301-415-4737/800-397-4209). The LRA may also be viewed at the Ida Rupp Library, 310 Madison Street, Port Clinton, OH, 43452, and at the Toledo-Lucas County Public Library, 352 North Michigan Street, Toledo, OH, 43604. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC website at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the unit's proposed operation for an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated December 2010.

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

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

In accordance with 10 CFR Part 51, and as part of the environmental review, the staff is also preparing a draft plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." Issued separately from this SER, this supplement will discuss the environmental considerations for the license renewal of Davis-Besse. A final, plant-specific GEIS supplement will be issued after consideration of public comment on the draft plant-specific GEIS.

1.2 License Renewal Background

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

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

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

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

1.2.1 Safety Review

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

- The regulatory process is adequate to ensure that the licensing bases of all currently operating plants maintain an acceptable level of safety with the possible exceptions of the detrimental aging effects on the functions of certain SSCs, as well as a few other safety-related issues, during the period of extended operation.
- The plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term.

In implementing these two principles, 10 CFR 54.4, "Scope," defines the scope of license renewal as including the following SSCs:

- those that are safety-related
- those whose failure could affect safety-related functions
- those that are relied on to demonstrate compliance with NRC regulations for fire protection, environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transient without scram (ATWS), and station blackout (SBO)

Pursuant to 10 CFR 54.21(a), a license renewal applicant must review all SSCs within the scope of 10 CFR Part 54 to identify SCs subject to an aging management review (AMR). Those SCs subject to an AMR are those which perform an intended function without moving parts or without 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"). Pursuant to 10 CFR 54.21(a), a license renewal applicant must demonstrate that the aging effects will be managed such that the intended function(s) of those SSCs will be maintained, consistent with the current licensing basis (CLB), for the period of extended operation. However, active equipment is considered to be adequately monitored and maintained by existing programs. In other words, detrimental aging effects that may affect active equipment can be readily identified and corrected through routine surveillance, performance monitoring, and maintenance.

Surveillance and maintenance programs for active equipment, as well as other maintenance aspects of plant design and licensing basis, are required throughout the period of extended operation.

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

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

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

In its LRA, the applicant stated that it used the process defined in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated 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. An applicant's willingness to commit to carrying out these staff-approved AMPs could potentially reduce the time, effort, and resources in reviewing an applicant's LRA and, thereby, improve the efficiency and effectiveness of the license renewal review process. The report is also a reference for both applicants and staff reviewers to quickly identify AMPs and activities that can provide adequate aging management during the period of extended operation. It is incumbent on the applicant to ensure that the conditions and operating experience at the plant are bounded by the conditions and operating experience for which the GALL Report was evaluated. If these bounding conditions are not met, the applicant should address the additional effects of aging and augment its AMP as appropriate.

1.2.2 Environmental Review

Environmental protection regulations are contained in 10 CFR Part 51. In December 1996, the staff revised the environmental protection regulations to facilitate the environmental review for license renewal. The staff prepared the GEIS to document its evaluation of the possible environmental impacts associated with renewing licenses of nuclear power plants. For certain types of environmental impacts, the GEIS contains generic findings that apply to all nuclear power plants and 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 also must include analyses of environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In accordance with NEPA and 10 CFR Part 51, the staff reviewed the plant-specific environmental impacts of license renewal, including whether there was new and significant information not considered in the GEIS. As part of its scoping process, the staff held two public meetings on November 4, 2010, at the Camp Perry Lodging and Conference Center in Port Clinton, OH, to identify plant-specific environmental issues that might impact Davis-Besse. The staff will issue a draft plant-specific GEIS supplement in 2011 and a final report in 2012.

1.3 Principal Review Matters

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

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

Pursuant to 10 CFR 54.19(b), the staff requires that the LRA include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." On this issue, the applicant stated the following in LRA Section 1.1.9:

> 10 CFR 54.19(b) requires that license renewal applications include "… conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current Indemnity Agreement (No. B-79) for Davis-Besse states, in Article VII, that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment (to the agreement). Item 3 of the Attachment to the indemnity agreement, as revised by Amendment No. 1, lists Davis-Besse facility operating license number NPF-3. FirstEnergy Nuclear Operating Company has reviewed the original indemnity agreement and Amendments 1 through 7. Neither Article VII nor Item 3 of the attachment specifies an expiration date for license number NPF-3. Therefore, no changes to the indemnity agreement are deemed necessary as part of this application. Should the license number be changed by NRC upon issuance of the renewed license, FirstEnergy Nuclear Operating Company requests that NRC amend the indemnity agreement to include conforming changes to Item 3 of the attachment and other affected sections of the agreement.

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

Pursuant to 10 CFR 54.21, the staff requires that the LRA contain the following:

- 10 CFR 54.21(a)—an integrated plant assessment
- 10 CFR 54.21(b)—a description of any CLB changes during the staff's review of the LRA
- 10 CFR 54.21(c)—an evaluation of TLAAs
- 10 CFR 54.21(d)—an USAR supplement

LRA Sections 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a), (b), and (c). LRA Appendix A satisfies the license renewal requirements of 10 CFR 54.21(d).

Pursuant to 10 CFR 54.21(b), the NRC requires that each year following submission of the LRA and at least 3 months before the scheduled completion of the staff's review, the applicant submit an LRA amendment identifying any CLB changes to the facility that affect the contents of the LRA, including the USAR supplement. By letter dated August 9, 2012, the applicant submitted an LRA update (Agencywide Document Access and Management System (ADAMS) Accession No. ML12229A139), which summarizes the CLB changes that have occurred during the staff's review of the LRA. This submission satisfies 10 CFR 54.21(b) requirements.

Pursuant to 10 CFR 54.22, the staff requires that the LRA include changes or additions to the technical specifications that are necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that "[n]o changes to the Davis-Besse Technical Specifications are required to support the 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 SRP-LR guidance. 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 documenting its evaluation of the staff's LRA review and 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.

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 set of ISG, as well as the SER sections in which the staff addresses them.

Table 1.4-1. Current interim staff guidance

ISG issue (approved ISG number)	Purpose	SER section
LR-ISG-2011-02	AMP for Steam Generators	3.0.3.1.18
LR-ISG-2011-05	Ongoing Review of Operating Experience	3.0.5

1.5 Summary of Open Items

As a result of its review of the LRA, including additional information submitted through June 4, 2013, the staff closed the four open items (OIs) previously identified in the "Safety Evaluation Report with Open Items Related to the License Renewal of Davis-Besse Nuclear Power Station," issued on July 31, 2012. Since the issuance of the SER with OIs, the staff identified a new issue and issued new RAIs. In response to these RAIs, the applicant has provided additional clarification on its Bolting Integrity Program (SER Section 3.0.3.2.2). As a result of the applicant's responses, the staff was able to close all OIs as well as resolve the new RAIs.

Open Item 3.0.3.2.15-1: Shield Building Crack (SER Section 3.0.3.3.9)

In October 2011, during hydro-demolition of the concrete shield building in order to perform a scheduled reactor head replacement, cracks were identified in the containment shield building. While investigating the extent of the cracking, additional cracks were identified around the shield building. The additional cracks were identified using an impulse response technique, and core bores were used to verify the impulse response results. Although the root cause determined the initial cracking was event driven, the staff was concerned that without an adequate AMP the cracks could grow and affect the safety function of the shield building during the period of extended operation. This issue was identified as OI 3.0.3.2.15-1.

By letter dated April 5, 2012, the applicant submitted a plant-specific AMP to address the cracking in the shield building. The applicant proposed to apply a waterproof coating to the shield building and to monitor existing core bores for indications of changes in the cracking. The staff issued several rounds of RAIs to clarify when the coating would be applied and how the coating and the core bores would be inspected during the period of extended operation. The staff also requested additional information on how the core bores would be selected and how the number of inspected core bores would be justified. By letter dated November 20, 2012, the applicant provided an updated AMP. By letter dated February 12, 2013, the applicant provided information to demonstrate the impact the cracking had on the shield building, and discussed why other structures were not susceptible to laminar cracking. The staff reviewed the information in these submittals and found it acceptable, as documented in SER Section 3.0.3.3.9. OI 3.0.3.2.15-1 is closed.

Open Item B.1.4-1: Operating Experience (SER Section 3.0.5)

The applicant did not fully describe how it will use future operating experience to ensure that the AMPs will remain effective for managing the aging effects during the period of extended operation. While some of the program descriptions contain statements indicating that future operating experience will be used to adjust the programs as appropriate, the details of this process were not fully described. For the majority of AMPs, it was not clear whether the applicant intended to monitor operating experience on an ongoing basis and to use it to ensure the continued effectiveness of the AMPs or to develop new AMPs, as necessary. This issue was identified as OI B.1.4-1.

By letters dated June 24, 2011, March 9, 2012; July 11, 2012; and August 16, 2012; the applicant provided additional information to describe how its operating experience review activities will ensure the continued effectiveness of the license renewal AMPs. The staff reviewed this information and evaluated the applicant's operating experience review activities based on the guidance in Final LR-ISG-2011-05, "Ongoing Review of Operating Experience," dated March 16, 2012. Based on its review, the staff determined that the applicant's programmatic activities for the ongoing review of operating experience are acceptable because (a) the activities will provide for the systematic review of plant-specific and industry operating experience concerning age-related degradation and aging management, and (b) as a result of these review activities, the applicant will enhance the AMPs or develop new AMPs when necessary to ensure that the effects of aging are adequately managed. OI B.1.4-1 is closed.

Open Item 4.2-1: Reactor Vessel Neutron Embrittlement (SER Section 4.2.2)

LRA Table 4.2-2 lists an initial upper-shelf energy (USE) value of 70 ft-lb for all Linde 80 beltline welds. The staff requested that the applicant explain the technical basis for the reactor vessel (RV) beltline welds' initial USE value of 70 ft-lbs, including the underlying statistics. The applicant stated that the 70 ft-lb initial USE value was based on an assessment from the Babcock and Wilcox Owners Group (B&WOG) Master Integrated Reactor Vessel Program (MIRVP) of available unirradiated Charpy USE data for Linde 80 weld material. The applicant stated that the MIRVP established a generic mean value for all Linde 80 welds using measured unirradiated Charpy USE data from archived specimens designated with plant-specific capsules from each of the participating MIRVP plants. The staff determined that the use of a statistically-derived generic mean initial USE value for a class of material (e.g., Linde 80 welds) is not sufficiently conservative for demonstrating compliance with USE requirements of 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements."

The applicant stated that the minimum initial USE value for the Linde 80 welds in the BAW-1803, "Correlations for Predicting the Effects of Neutron Radiation on Linde 80 Submerged-Arc Welds," Revision 1, May 1991, database is 64 ft-lbs. The staff reviewed the database in the report and noted that the B&WOG selected the minimum initial USE value of 64 ft-lb by discounting the lowest value from the database of 56 ft-lbs. The staff determined that an initial USE value of 56 ft-lbs results in projected 52 effective full power year (EFPY) USE values that are below the 50 ft-lbs minimum specified in 10 CFR Part 50, Appendix G, for the non-limiting Linde 80 welds, WF-232 and WF-233, thereby dictating that 52 EFPY equivalent margins analysis (EMA) be performed for these welds. The staff determined that the applicant must provide additional justification for the selection of initial USE values greater than 56 ft-lbs for its Linde 80 beltline welds. Alternatively, the applicant must submit specific data documenting EMAs that are valid through 52 EFPY for welds WF-232 and WF-233 in order to demonstrate that these welds will maintain margins of safety against fracture equivalent to those required by the ASME Code, Section XI, Appendix G. This issue was identified as OI 4.2-1.

The applicant provided 52 EFPY EMAs for the RV shell region weld materials to demonstrate that the requirements of the ASME Code, Section XI, Appendix G for 52 EFPY are met. The staff finds this acceptable because the EMAs for weld materials demonstrate that the welds will maintain the required margins against ductile fracture in accordance with 10 CFR Part 50, Appendix G for the period of extended operation and the applicant correctly implemented the methods of the ASME Code. OI B.1.4-1 is closed.

Open Item 4.2.4-1: Pressure-Temperature (P-T) Limits (SER Section 4.2.4)

The current Davis-Besse P-T limits report (PTLR) contains P-T limit curves that are valid through 32 EFPY. These P-T limit curves were calculated using adjusted RT_{NDT} values for the limiting RV beltline shell material. The staff notes that 10 CFR Part 50, Appendix G states, "this appendix specifies fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor coolant pressure boundary (RCPB) of light water nuclear power reactors to provide adequate margins of safety…" In addition, 10 CFR Part 50, Appendix G, Paragraph IV.A states that, "the pressure-retaining components of the RCPB that are made of ferritic materials must meet the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), supplemented by the additional requirements set forth in [paragraph IV.A.2, "Pressure-Temperature (P-T) Limits and Minimum Temperature Requirements"]…" Therefore, 10 CFR Part 50, Appendix G requires that P-T limits be developed for the entire RCPB, consisting of ferritic RCPB materials in the RV beltline region, as well as ferritic RCPB materials not in the RV beltline region.

The staff was concerned that P-T limit calculations for ferritic RCPB components that are not RV beltline shell materials may define curves that are more limiting than those calculated for the RV beltline shell materials. This issue was identified as OI 4.2.4-1.

In its RAI responses the applicant stated that it used NRC approved methods (B&W topical report BAW-10046-A, Revision 2) to develop the P-T limits curves. The applicant also stated that requirements of ASME Code, Section III, (which includes the lowest service temperature requirement of NB-2332(b)) will ensure that the fracture toughness of replacement ferritic RCPB components at Davis-Besse will comply with the requirements of 10 CFR Part 50, Appendix G. The applicant also revised the LRA to state that P-T limits for the period of extended operation will take into consideration the evaluation of the effects of neutron embrittlement for the extended beltline materials as well as the high localized stresses in the closure head region of the RV and the inside corner of the RV outlet nozzles. The staff reviewed this information and found it acceptable because the LRA revisions provide adequate assurance that future P-T limit curves will be developed such that they are bounding for all ferritic RCPB materials during the period of extended operation, consistent with the requirements of 10 CFR Part 50, Appendix G. OI 4.2.4-1 is closed.

1.6 Summary of Confirmatory Items

There are no confirmatory items associated with this SER.

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 five proposed license conditions.

The first license condition requires the information in the USAR supplement, submitted pursuant to 10 CFR 54.21(d), as revised during the license renewal application review process and supplemented by Appendix A of the "Safety Evaluation Report Related to the License Renewal of Davis-Besse Nuclear Power Station," to be part of the USAR which will be updated in accordance with 10 CFR 50.71(e), following the issuance of the renewed license. As such, the applicant may make changes to the programs and activities described in the USAR supplement, provided the applicant evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

The second license condition states that the applicant's USAR supplement submitted pursuant to 10 CFR 54.21(d), as supplemented by Appendix A of the "Safety Evaluation Report Related to the License Renewal of Davis-Besse Nuclear Power Station," describes certain future programs and activities to be completed before the period of extended operation.

a. The applicant shall implement those new programs and enhancements to existing programs no later than October 22, 2016, (i.e., no later than 6 months prior to the period PEO).

b. The applicant shall complete those activities as noted in Commitment Nos. 26, 33 (Phase 1, Action 1; Phase 2, Action 1), 35 (Phase 1), 37 (Phase 1), 39 (Phase 1) by December 31, 2014. The applicant shall complete those activities as noted in Commitment No. 15

by April 22, 2015. The applicant shall complete those activities as noted in Commitment Nos. 23, 33 (Phase 1, Action 2), 38, 44, and 48, no later than October 22, 2016.

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

LRA Appendix A, "Updated Safety Analysis Report Supplement," Table A-1, “Davis-Besse License Renewal Commitments,” contains commitments for license renewal and an associated schedule for when the applicant plans to implement or complete the commitments. The staff noted that through the commitments in LRA Appendix A, Table A-1, the applicant will implement new programs, implement enhancements to existing programs, and will also complete inspection or testing activities. The staff also noted that Davis-Besse current license expires on April 22, 2017. Therefore, the applicant’s implementation schedule for some commitments, as provided originally in LRA Section Appendix A, Table A-1, may conflict with the implementation schedule intended by the generic second license condition described above. By letter dated March 26, 2013, the staff issued RAI A.1-1, Part (1), requesting the applicant to identify those commitments to implement new programs and enhancements to existing programs and state when the implementation of these programs will be completed. In addition, RAI A4-1, Part (2), requested the applicant to identify those commitments to complete inspection or testing activities and state when the completion of these inspection and testing activities will occur.

In response to RAI A.1-1, Part (1), the applicant identified Commitment Nos. 1 through14, 16 through 21, 25, 27 through 32, 34, 40, 45 through 47, and 49, as those commitments associated with implementation of new programs and enhancements to existing programs. The applicant stated that these commitments will be completed no later than October 22, 2016. As part of its response, the applicant also provided LRA Amendment 40 which revised the implementation schedule in LRA Appendix A, Table A-1 for these commitments to state that they will be completed no later than October 22, 2016. In response to RAI A4-1, Part (2), the applicant identified Commitment Nos. 22 through 24, 38, 41, 43, 44, and 48, as those commitments associated with inspection and testing activities. The applicant stated that these commitments will be completed no later than October 22, 2016. The applicant also revised the implementation schedule in LRA Appendix A, Table A-1 to state that these commitments will be completed no later than October 22, 2016.

The staff finds the applicant response to RAI A.1-1, Part (1) acceptable because the applicant identified those commitments that implement new programs and enhancements to existing programs and revised the implementation schedule on LRA Appendix A, Table A-1 to complete these commitments 6 months before the period of extended operation, which is consistent with the proposed second license condition. The staff finds the applicant response to RAI A.1-1, Part (2) acceptable because the applicant identified those commitments to complete inspection or testing activities and revised the implementation schedule on LRA Appendix A, Table A-1, consistent with the proposed second license condition, to state that these commitments will be implemented 6 months before the period of extended operation. Therefore, the staff’s concerns described in RAI A.1-1, Parts (1) and (2), are resolved.

The third license condition requires testing of surveillance capsules for the period of extended operation to meet the test procedures and reporting requirements of ASTM E 185-82 to the extent practicable for the configuration of the specimens in the capsule. All pulled capsules shall be properly maintained for testing, and any changes to storage requirements must be approved by the NRC. All pulled and tested capsules, unless discarded before August 31, 2000, shall be placed in storage to be saved for possible future reconstitution and use.

The fourth license condition states that FENOC will access the inside surface of the embedded steel containment, via core bore, by December 31, 2014. If there is evidence of the presence of borated water in contact with the steel containment vessel, the applicant will conduct non-destructive testing to determine the effect, if any, that the borated water has had on the containment vessel. The applicant will perform an evaluation of the effect of any loss in containment vessel thickness due to exposure to borated water through the period of extended operation. If the loss in containment vessel thickness exceeds 10 percent of the nominal wall thickness, the applicant will submit to the NRC a report consisting of a summary of the results of the core bore and associated evaluations within 90 days following the completion of testing. If water is detected in the first core bore, or if the refueling cavity leakage continues, the applicant will perform a second core bore by December 31, 2020. At that time, the applicant will perform an evaluation of the effect of any loss in containment vessel thickness through the remainder of the period of extended operation. If there is greater than 10 percent loss in containment vessel thickness, a summary of the core bore results and associated evaluations shall be submitted to the NRC staff within 90 days following the completion of testing.

The fifth license condition states that the applicant shall perform inspections and replacements in accordance with Section 4 of MRP-227-A, “Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A),” including those for components named in Applicant/Licensee Action Items 4, 6, or 7, as described in the NRC Safety Evaluation, Revision 1, on MRP-227, unless a plant-specific inspection plan has been approved by the NRC staff.

Per the applicant's Commitment No. 15 and the staff's proposed second license condition above, the staff expects the applicant to submit a plant-specific inspection plan prior to April 22, 2015, for the staff's review and approval. If the inspection plan is approved by the staff, then the requirements of license condition No. 5 would be satisfied.

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 an integrated plant assessment (IPA) for each license renewal application (LRA). The IPA must list and identify all of the structures, systems, and components (SSCs) within the scope of license renewal and all structures and components (SCs) subject to an aging management review (AMR) in accordance with 10 CFR 54.4.

LRA Section 2.1, "Scoping and Screening Methodology," describes the scoping and screening methodology used to identify the SSCs at the Davis-Besse Nuclear Power Station, Unit 1, (Davis-Besse) within the scope of license renewal and the SCs subject to an AMR. The staff reviewed the scoping and screening methodology of the FirstEnergy Nuclear Operating Company (FENOC 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 stated that it considered the following:

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

Additionally, in developing this methodology, the applicant stated that it considered the correspondence between the U.S. Nuclear Regulatory Commission (NRC or the staff), other applicants, and NEI.

2.1.2 Summary of Technical Information in the Application

In LRA Sections 2 and 3, the applicant provides the technical information required by 10 CFR 54.4, "Scope," and 10 CFR 54.21(a). This final safety evaluation report (SER), contains sections entitled "Summary of Technical Information in the Application," which provide information taken directly from the LRA. In LRA Section 2.1, the applicant 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). The applicant provided the results of the process used for identifying the SCs subject to an AMR in the following LRA Sections:

- LRA Section 2.2, “Plant-Level Scoping Results”
- LRA Section 2.3, “Scoping and Screening Results: Mechanical Systems”
- LRA Section 2.4, “Scoping and Screening Results: Structures”
- LRA Section 2.5, “Scoping and Screening Results: Electrical and Instrumentation and Controls Systems”

In LRA Section 3.0, “Aging Management Review Results,” the applicant describes its aging management results as follows:

- LRA Section 3.1, “Aging Management of Reactor Vessel, Internals, and Reactor Coolant System and Reactor Coolant Pressure Boundary, and Steam Generators”
- LRA Section 3.2, “Aging Management of Engineered Safety Features Systems”
- LRA Section 3.3, “Aging Management of Auxiliary Systems”
- LRA Section 3.4, “Aging Management of Steam and Power Conversion Systems”
- LRA Section 3.5, “Aging Management of Containment, Structures, and Component Supports”
- LRA Section 3.6, “Aging Management of Electrical and Instrumentation and Control Systems”

2.1.3 Scoping and Screening Program Review

The staff evaluated the LRA scoping and screening methodology in accordance with the guidance contained in NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” (SRP-LR), Section 2.1, “Scoping and Screening Methodology.” The following regulations 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 10 CFR 54.21(a)(2), as they relate to the methods used by the applicant to identify plant SCs subject to an AMR

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

- Section 2.1, to ensure that the applicant described a process for identifying SSCs that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)
- Section 2.2, 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 the Davis-Besse facility located on the southwestern shore of Lake Erie in Ottawa County in northwestern Ohio, during the week of January 24–28, 2011. The audit focused on ensuring that the applicant developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the LRA and the requirements of the Rule. The staff reviewed implementation of the project-level guidelines and topical reports describing the applicant's scoping and screening methodology. The staff conducted detailed discussions with the applicant on the implementation and control of the license renewal program and reviewed the administrative control documentation used by the applicant during the scoping and screening process, the quality practices used by the applicant to develop the LRA, and the training and qualification of the LRA development team.

The staff evaluated the quality attributes of the applicant's aging management program (AMP) activities described in Appendix A, "Updated Safety Analysis Report Supplement," and Appendix B, "Aging Management Programs," of the LRA. On a sampling basis, the staff performed a system review of the service water, emergency diesel generators (EDGs) and support systems, main feedwater, auxiliary feedwater (AFW), and the turbine building, including a review of the scoping and screening results reports and supporting design documentation used to develop the reports. The purpose of the staff's review was to ensure that the applicant appropriately implemented the methodology outlined in the administrative controls and to verify that the results are consistent with the current licensing basis (CLB) documentation.

2.1.3.1 Implementation Procedures and Documentation Sources for Scoping and Screening

The staff reviewed the applicant's scoping and screening implementing procedures as documented in the scoping and screening methodology audit trip report, dated April 19, 2011, (Agencywide Document Access and Management System (ADAMS) Accession No. ML111050091), 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 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:

- Davis-Besse updated safety analysis report (USAR)
- Davis-Besse SERs
- Davis-Besse docketed information sources
- Design Criteria Manual
- Maintenance Rule Program Manual (MRPM)
- system description documents
- plant engineering drawings
- piping calculations
- plant procedures
- design-basis event (DBE) information
- other controlled information sources

2.1.3.1.2 Staff Evaluation

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

The applicant's implementing procedures contain guidance for determining plant SSCs within the scope of the Rule and for determining which SCs within the scope of license renewal are subject to an AMR. During the review of the applicant's implementing procedures, the staff focused on the consistency of the detailed procedural guidance with information in the LRA, including the implementation of NRC staff positions documented in the SRP-LR, and the information in the applicant's responses, dated April 29, 2011, to the staff's requests for additional information (RAIs) dated March 30, 2011.

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

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

During the audit, the staff reviewed pertinent information sources used by the applicant, including the USAR and license renewal drawings. In addition, the applicant's license renewal process identified additional sources of plant information pertinent to the scoping and screening process, including the Quality Classification List (which is derived from the Davis-Besse configuration database), controlled drawings, analyses, and reports. 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 configuration database, USAR, and plant drawings were the applicant's primary repository for system identification and component safety classification information. During the audit, the staff discussed the applicant's administrative controls for the configuration database and other information sources used to verify system information. These controls are described and implementation is governed by plant procedures. Based on a review of the administrative controls, and a sample of the system classification information contained in the applicable

Davis-Besse documentation, the NRC staff concludes that the applicant established adequate measures to control the integrity and reliability of Davis-Besse system identification and safety classification data. Therefore, the staff concludes that the information sources used by the applicant during the scoping and screening process provided a sufficiently controlled source of system and component data to support scoping and screening evaluations.

During the staff's review of the applicant's CLB evaluation process, the applicant explained the incorporation of updates to the CLB and the process used to ensure those updates are adequately incorporated into the license renewal process. The staff determined that LRA Section 2.1 provides 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 applicant's implementing procedures and results reports used to support identification of SSCs that the applicant relied on to demonstrate compliance with the safety-related criteria, nonsafety-related criteria, and the regulated events criteria pursuant to 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a listing of documents used to support scoping and screening evaluations. The staff finds these design documentation sources to be useful for ensuring that the initial scope of SSCs identified by the applicant was consistent with the plant's CLB.

2.1.3.1.3 Conclusion

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

2.1.3.2 Quality Controls Applied to License Renewal Application Development

2.1.3.2.1 Staff Evaluation

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

- The applicant developed written procedures to direct implementation of the scoping and screening methodology, to control LRA development, and to describe training requirements and documentation.
- The applicant's reviews of the LRA included management and technical reviews, industry peer review and sufficiency check, and licensing reviews by Fleet Licensing, Corporate Legal, the Plant Operations Review Committee, and the Corporate Nuclear Review Board for License Amendment Requests.
- The LRA submittal review and approval was performed by the License Renewal Project Manager, Davis-Besse Senior Leadership Team, and Fleet Licensing Manager.
- The comments received throughout the review process were addressed. The audit team reviewed a sample of comment resolution documentation and determined that the applicant's comment resolution process is consistent and adequate.

- The applicant used its open item tracking system to capture any identified issues for resolution.

The staff performed a sample review of reports and LRA development procedures, reviewed the applicant’s documentation of the activities performed, and held discussions with the applicant’s license renewal personnel to assess the quality of the LRA. The staff determined that the applicant’s activities assure that LRA development was consistent with the applicant’s license renewal program requirements.

2.1.3.2.2 Conclusion

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

2.1.3.3 Training

2.1.3.3.1 Staff Evaluation

The staff reviewed the applicant’s training process to ensure the guidelines and methodology for the scoping and screening activities were applied in a consistent and appropriate manner. As outlined in the applicant's implementing procedure, the applicant requires training for personnel participating in the development of the LRA and uses 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, which followed documented procedures.
- An initial orientation training and overview was provided to license renewal personnel for familiarization with NRC regulations and industry guidance.
- The training for license renewal project personnel included required reading and general review.
- Orientation was provided to FENOC personnel other than the license renewal team, such as subject matter experts and AMP owners.
- Applicant personnel and their license renewal contractor had previous license renewal experience and participated in license renewal industry working groups.

The staff reviewed the applicant’s written procedures and, on a sampling basis, reviewed completed training records of license renewal personnel. The staff determined that the applicant developed and implemented adequate controls for the training of personnel performing LRA activities.

2.1.3.3.2 Conclusion

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

2.1.3.4 Conclusion of Scoping and Screening Program Review

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

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

LRA Section 2.1 described the applicant's methodology used to scope SSCs pursuant to the requirements of the 10 CFR 54.4(a) criteria. The LRA states that the scoping process established a listing of plant systems and structures, determined the functions they perform, and then determined which functions meet one or more of the three criteria of 10 CFR 54.4(a). The LRA states that that the scoping process identified the SSCs that are safety-related and perform or support an intended function for responding to a design-basis event (DBE); are nonsafety-related but their failure could prevent accomplishment of a safety-related function; or support a specific requirement for one of the five regulated events applicable to license renewal. LRA Section 2.1.1, "Scoping Methodology," states that the scoping methodology used by Davis-Besse is consistent with 10 CFR Part 54 and with the industry guidance contained in NEI 95-10.

2.1.4.1 Application of the Scoping Criteria in Title 10 Part 54.4(a)(1) of the Code of Federal Regulations

2.1.4.1.1 Summary of Technical Information in the Application

Pursuant to 10 CFR 54.4(a)(1), safety-related SSCs relied upon to remain functional during and following DBEs are within the scope of license renewal. LRA Section 2.1.1.1, "Safety-Related Scoping Criteria," describes the scoping methodology as it relates to the safety-related criterion pursuant to 10 CFR 54.4(a)(1). The LRA states that safety-related SSCs at Davis-Besse are designated as quality Class "Q." The LRA also states that SSCs classified as safety-related ("Q") are identified in Davis-Besse Quality Classification List. The LRA further states that the USAR, Quality Classification List, and piping and instrument diagrams (P&IDs) were reviewed to include within the scope of license renewal all safety-related SSCs that meet the criteria of 10 CFR 54.4(a)(1).

2.1.4.1.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied upon to remain functional during and following a DBE to ensure the following functions:

- the integrity of the reactor coolant pressure boundary (RCPB)
- the ability to shut down the reactor and maintain it in a safe shutdown condition

- the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11

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

> The set of DBEs as defined in the Rule is not limited to Chapter 15 (or equivalent) of the USAR. 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 USAR, the Commission's regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify SSCs relied upon to remain functional during and following DBEs (as defined in 10 CFR 50.49(b)(1)) to ensure the functions described in 10 CFR 54.4(a)(1).

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

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

The staff reviewed the applicant's evaluation of the Rule and CLB definitions pertaining to 10 CFR 54.4(a)(1) and determined that the Davis-Besse CLB definition of safety-related ("Q") met the definition of safety-related specified in the Rule. The staff reviewed a sample of the license renewal scoping results for the service water, EDGs and support systems, main feedwater, AFW systems, and the turbine building to provide additional assurance that the applicant adequately implemented their scoping methodology with respect to 10 CFR 54.4(a)(1). The staff confirmed that the applicant 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 identified and used pertinent engineering and licensing information to identify the SSCs required to be within the scope of license renewal in accordance with the 10 CFR 54.4(a)(1) criteria.

2.1.4.1.3 Conclusion

On the basis of its review of systems (on a sampling basis), discussions with the applicant, and 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 Title 10, Part 54.4(a)(2) of the Code of Federal Regulations

2.1.4.2.1 Summary of Technical Information in the Application

Pursuant to 10 CFR 54.4(a)(2), all nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any of the safety functions identified in 10 CFR 54.4(a)(1) are within the scope of license renewal. LRA Section 2.1.1.2, “Nonsafety-Affecting-Safety Scoping Criteria,” states that Davis-Besse methodology to consider the impact of failures of nonsafety-related SSCs is consistent with the scoping guidance of Appendix F of NEI 95-10.

LRA Section 2.1.1.2.1, “Functional Failures of Nonsafety-Related SSCs,” states that nonsafety-related SSCs required to remain functional in support of a safety function were included within the scope of license renewal pursuant to 10 CFR 54.4(a)(2).

LRA Section 2.1.1.2.2, “Spatial Failures of Nonsafety-Related SSCs,” states that nonsafety-related systems and nonsafety-related portions of safety-related systems are within the scope of license renewal pursuant to 10 CFR 54.4(a)(2) if there is a potential for spatial interaction between SSCs that could adversely impact the safety-related function of safety-related SSCs.

The LRA states that protective features such as missile barriers, flood barriers, and spray shields were included within the scope of license renewal. The LRA also states that “the preventive option described in Appendix F of NEI 95-10 was used to determine the scope of license renewal with respect to the protection of safety-related SSCs from spatial interactions that are not addressed in the [CLB].” The LRA further states that a “space” approach was used to evaluate for potential spatial interactions in all fluid-containing components and components associated with safety-related to nonsafety-related interfaces.

The staff notes that Class I are SSCs designed to remain functional if the safe-shutdown earthquake ground motion occurs. The LRA states that Seismic Class I boundaries may extend to the first seismic restraint beyond the safety-related boundary. The LRA also states that for nonsafety-related piping attached to safety-related piping, all nonsafety-related piping up to the first seismic restraint beyond the safety-related boundary is within the scope of license renewal.

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, for SSCs relied on to remain functional during and following a DBE to ensure the following:

- the integrity of the reactor coolant pressure boundary
- the ability to shut down the reactor and maintain it in a safe shutdown condition

- 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

Regulatory Guide (RG) 1.188, Revision 1, endorses the use of NEI 95-10, Revision 6. NEI 95-10 discusses the staff's position on 10 CFR 54.4(a)(2) scoping criteria including:

- nonsafety-related SSCs typically identified in the CLB
- consideration of missiles, cranes, flooding, and high-energy line breaks (HELBs)
- nonsafety-related SSCs connected to safety-related SSCs
- nonsafety-related SSCs in proximity to safety-related SSCs
- mitigative and preventive 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 applicant should not consider hypothetical failures but, rather, should base their evaluation on the plant's CLB, engineering judgment and analyses and relevant operating experience. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports (CRs), industry reports such as safety operational event reports, and engineering evaluations. The staff reviewed LRA Section 2.1.2.2 in which the applicant described the scoping methodology for nonsafety-related SSCs pursuant to 10 CFR 54.4(a)(2). In addition, the staff reviewed the applicant's implementing document and results report, which documented 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 the review in accordance with the guidance contained in NEI 95-10, Revision 6, Appendix F.

<u>Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC</u>. The staff determined that nonsafety-related SSCs required to remain functional to support a safety-related function had been reviewed by the applicant for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluation criteria discussed in LRA Section 2.1.1.2.1 and the applicant's 10 CFR 54.4(a)(2) implementing document. The staff confirmed that the applicant reviewed the USAR, plant drawings, plant equipment database, and other CLB documents to identify the nonsafety-related systems and structures that function to support a safety-related system whose failure could prevent the performance of a safety-related intended function. The applicant also considered missiles, overhead handling systems, internal and external flooding, and HELBs. Accordingly, the staff finds that the applicant implemented an acceptable method for including nonsafety-related systems that perform functions that support safety-related intended functions within the scope of license renewal, as required by 10 CFR 54.4(a)(2).

<u>Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs</u>. The staff confirmed that nonsafety-related SSCs that are directly connected to SSCs had been reviewed by the applicant for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in LRA Section 2.1.1.2.2 and the applicant's 10 CFR 54.4(a)(2) implementing document. The applicant reviewed the safety-related to nonsafety-related interfaces for each mechanical system to identify the nonsafety-related

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

The staff determined that, 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, Revision 6, Appendix F (base-mounted component, flexible connection, inclusion to the free end of nonsafety-related piping, or inclusion of the entire piping run)

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, the applicant's 10 CFR 54.4(a)(2) implementing documents, and license renewal drawings, and also performed plant walkdowns. Through a review of license renewal documents and discussion with the applicant, the staff determined that, for certain systems, nonsafety-related pipe attached to safety-related pipe had not been included within the scope of license renewal.

By letter dated March 30, 2011, the staff issued RAI 2.1-2. In its RAI the staff requested the applicant to provide details of the analysis performed and any conclusions related to nonsafety-related pipe attached to safety-related pipe, for inclusion within the scope of license renewal up to and including a seismic anchor or equivalent, in accordance with 10 CFR 54.4(a)(2). During the review of this issue, the staff asked the applicant to consider the extent of condition and indicate if the review concludes that use of the scoping methodology precluded the identification of SSCs, which should have included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

In its response dated April 29, 2011, the applicant stated the following:

> In-scope nonsafety-related mechanical components that are directly connected to safety-related piping and piping components are highlighted on the license renewal boundary drawings beyond the safety-related (Q) boundary to the limits of the Seismic Class I analysis boundary [boundaries of seismic Class I design requirements extending to the first seismic restraint beyond the safety-related boundary], designated as "S/I" on the Piping and Instrument[ation] Diagrams (P&IDs). …
>
> However, as identified during the scoping and screening methodology audit, the locations of the S/I boundaries were incomplete on plant P&IDs. … Calculations were performed as necessary to confirm Seismic Class I analysis boundaries, and the P&IDs were updated to include the S/I boundaries.
>
> …Based on the updated S/I boundaries, highlighting is added to or removed from the license renewal drawings to bring additional components within the scope of license renewal or remove components from the scope of license renewal.

The staff reviewed the applicant's response to RAI 2.1-2, along with the information contained in the LRA, and determined that the applicant described the process used to evaluate nonsafety-related pipe attached to safety-related pipe, which had not initially been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff determined that, subsequent to the scoping and screening methodology audit, the applicant re-evaluated the seismic interface boundaries and correctly identified the portion of nonsafety-related pipe, attached to safety-related pipe. Additionally, the applicant expanded the boundaries to incorporate additional portions of the nonsafety-related pipe up to and including a seismic anchor or equivalent, and included the additional portion, as necessary, within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). In addition, the applicant supplemented the information in the LRA to include the required AMR information for the applicable systems. The staff's concern described in RAI 2.1-2 is resolved.

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, the applicant's 10 CFR 54.4(a)(2) implementing documents, and license renewal drawings, and also performed plant walkdowns. During a plant walkdown, the staff observed the nonsafety-related condensate line located in the turbine building that exited through the deck to the space below containing the AFW pumps. The applicant indicated that the condensate line nonsafety-related to safety-related interface was located at a point below the turbine building deck.

By letter dated March 30, 2011, the staff issued RAI 2.1-7 requesting that the applicant identify the specific location of the nonsafety to safety-related interface and all mitigative features installed to protect the integrity of the nonsafety to safety-related interface. The staff requested that the applicant provide the evaluation of all components and structures relied upon to protect the safety and nonsafety interface for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

In its response dated April 29, 2011, the applicant stated the following:

> The specific location of the nonsafety-related (NSR)-to-safety-related interface (i.e., Q boundary) for the auxiliary feedwater pump suction from the Condensate System is at a pipe anchor encased in grout located six inches below the Turbine Building floor surface in the safety-related Auxiliary Building ceiling. Mitigative features were recently installed to protect the integrity of the Q boundary. The mitigative features are a missile shield, pipe supports and a stainless steel pipe segment. Missile shields and pipe supports are within the scope of license renewal and evaluated as Structural Bulk Commodities in LRA Table 3.5.2-13 …. The supported piping is within the scope of license renewal as part of the in-scope suction piping for the Auxiliary Feedwater (AFW) Pumps. …

Based on its review, the staff finds the applicant's response to RAI 2.1-7 acceptable because: (1) the applicant identified the location of the nonsafety-related to safety-related interface, (2) the applicant identified the mitigative features used to protect the integrity of the nonsafety-related to safety-related interface, and appropriately included the mitigative features within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), and (3) the applicant supplemented the information in the LRA to include newly identified material and the associated AMR information for the applicable systems. The staff's concern described in RAI 2.1-7 is resolved.

<u>Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs</u>. The staff confirmed that nonsafety-related SSCs with the potential for spatial interaction with safety-related SSCs had been reviewed by the applicant for inclusion within the scope of license

renewal, in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in the LRA Section 2.1.1.2.2 and the applicant's 10 CFR 54.4(a)(2) implementing procedure. 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 staff further confirmed that the applicant used a spaces approach to identify the portions of nonsafety-related systems with the potential for spatial interaction with safety-related SSCs. The spaces approach focused on the interaction between nonsafety-related and safety-related SSCs that are located in the same space, which was defined for the purposes of the review as a structure containing active or passive safety-related SSCs.

LRA Section 2.1.1.2.2 and the applicant's implementing document state that the applicant included mitigative features when considering the impact of nonsafety-related SSCs on safety-related SSCs for occurrences discussed in the CLB. The staff reviewed the applicant's CLB information, primarily contained in the USAR, related to missiles, crane load drops, flooding and HELBs. The staff determined that the applicant also considered the features designed to protect safety-related SSCs from the effects of these occurrences through the use of mitigating features such as floor drains and curbs. The staff confirmed that the applicant included the mitigating features within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

LRA Section 2.1.1.2.2 and the applicant's implementing document state that the applicant used a preventive approach, which considered the impact of nonsafety-related SSCs contained in the same space as safety-related SSCs. The staff determined that the applicant evaluated all nonsafety-related SSCs containing liquid or steam and located in spaces containing safety-related SSCs. The applicant used a spaces approach to identify the nonsafety-related SSCs that were located within the same space as safety-related SSCs. As described in the LRA, and for the purpose of the scoping review, a space was defined as a structure containing active or passive safety-related SSCs. In addition, the staff determined that, following the identification of the applicable mechanical systems, the applicant identified its corresponding structures for potential spatial interaction, based on a review of the CLB and plant walkdowns. Nonsafety-related systems and components that contain liquid or steam and located inside structures that contain safety-related SSCs were included within the scope of license renewal, unless it was evaluated and determined not to contain safety-related SSCs. The staff also determined that, based on plant and industry operating experience, the applicant excluded the nonsafety-related SSCs containing air or gas from the scope of license renewal, with the exception of portions that are attached to safety-related SSCs and required for structural support. The staff confirmed that those nonsafety-related SSCs determined to contain liquid or steam 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).

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. During the scoping and screening methodology audit performed onsite January 24–28, 2011, the staff determined that the applicant identified safety-related components located in the turbine building. The applicant also confirmed that there are nonsafety-related SSCs in the vicinity of the safety-related components. The applicant concluded that the nonsafety-related SSCs were not required to be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

By letter dated March 30, 2011, the staff issued RAI 2.1-1, asking the applicant to provide a description of the results of the evaluation that formed the basis for concluding that the nonsafety-related SSCs, located within the vicinity of safety-related SSCs within the turbine building, do not meet the criteria for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2) for spatial interaction.

In its response dated April 29, 2011, the applicant stated the following:

> … Fail-safe components are components whose failure (through interaction with the failed nonsafety-related SSC) cannot prevent the accomplishment of the safety-related intended function. As long as the nonsafety-related SSC failure causes the safety-related SSC to attain its fail-safe state, the nonsafety-related SSCs would not be considered in-scope for 10 CFR 54.4(a)(2). This approach is applied to the following systems and components:
>
> - The safety-related (Q) components of the startup feedwater pump and auxiliaries system that are located in the turbine building are the position controllers for control valves DB-FV6459 and DB-FV6460. As shown on license renewal drawing LR-MO06D, these control valves fail open and the valve position controller is energized to close the valve, so the associated control valve opens on a loss of signal from the controller. …
> - The safety-related (Q) components of the anticipatory reactor trip system (ARTS) are the pressure switches. … The ARTS is a fail-safe, de-energize-to-trip system.
> - The safety-related (Q) components of the main feedwater pump turbine oil system are drain valves associated with the ARTS pressure switches. …
>
> The following components will be protected [by a mitigative feature] in such a way as to prevent spatial interaction:
>
> - The safety-related (Q) radiation monitoring components that are located in the turbine building are associated with station vent normal and accident range monitors DB-RE4598AA, AB, BA, and BB. …
>
>   FENOC has made a commitment [Commitment No. 22] for license renewal, item number 22 of Table A-1 of the license renewal application (LRA), to enclose, or otherwise provide protection for, the station vent radiation monitors such that leakage and spray from surrounding piping systems does not cause age-related degradation, which would prevent them from performing their intended functions.

The staff reviewed the applicant's response to RAI 2.1-1, along with the information contained in the LRA, and determined that safety-related SSCs located in the turbine building were either fail-safe or will have mitigative features installed prior to the period of extended operation. Therefore, the failure of nonsafety-related SSCs in the vicinity would not prevent the performance of a safety-related intended function. The staff determined that the applicant provided a basis for not requiring the inclusion of nonsafety-related SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff's concern described in RAI 2.1-1 is resolved.

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, the applicant's

10 CFR 54.4(a)(2) implementing documents, and license renewal drawings, and also performed plant walkdowns. The applicant indicated during discussions with the staff, that equipment that was no longer required had been placed in an abandoned state.

By letter dated March 30, 2011, the staff issued RAI 2.1-3 requesting the applicant to provide details on the activities performed to confirm that all abandoned equipment that at any time contained fluids, and is in the proximity of safety-related SSCs, has been confirmed to be drained. If abandoned equipment has not been confirmed to be drained or is not included within the scope of license renewal, the staff asked the applicant to provide details of the analysis performed and any conclusions related to the inclusion of abandoned equipment within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). During the review of this issue, the staff asked the applicant to consider the extent of the condition and indicate if the review concludes that use of the scoping methodology precluded the identification of SSCs, which should have been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

In its response dated April 29, 2011, the applicant stated the following:

> FENOC provides the following new license renewal future commitment [Commitment 26] regarding abandoned equipment, which will be included in LRA Appendix A, "Updated Safety Analysis Report Supplement," Table A-1, "Davis-Besse License Renewal Commitments":
>
>> Prior to the period of extended operation, FENOC will review all License Renewal scoping drawings and Aging Management Review reports to ensure identification of components that would have been in scope under 10 CFR 54.4(a)(2), but were excluded from aging management because they are abandoned. For each such component or set of components, FENOC will ensure administrative controls are in place to maintain the components isolated from fluid sources and drained.
>
> If any additional components are determined to be within the scope of License Renewal as a result of this review, they will be addressed in an amendment to the LRA (if identified during the LRA review process), or during the periodic [updated final safety analysis report] UFSAR update required by 10 CFR 50.71(e), as specified in 10 CFR 54.37(b).

The staff reviewed the applicant's response to RAI 2.1-3, along with the information contained in the LRA, and determined that the applicant's RAI response needed further clarification. On September 7, 2011, the staff held a telephone call with the applicant requesting additional clarification on its plans to determine the status of the Davis-Besse abandoned equipment. In response to the teleconference call by letter dated September 16, 2011, the applicant provided a supplemental response to RAI 2.1-3. In its response, the applicant deleted Commitment No. 26 and stated the following:

> FENOC plans to perform the following actions by February 15, 2012, to ensure abandoned equipment is identified, isolated, and drained:
>
> 1. Determine the scope of abandoned equipment—includes review of piping [and] instrumentation diagrams (P&IDs), plant walkdowns, and review of the shift operations management system (eSOMS) clearance database.

2. Determine the status of abandoned equipment—includes review of system status files and the eSOMS database for as-left valve positions, walkdowns to validate valve position status, and ultrasonic testing to confirm that abandoned piping is drained.

3. Place abandoned equipment in a configuration that will not impact safety-related equipment—create and implement operations evolution orders to isolate and drain abandoned systems with fluids, and create and implement document change requests as necessary to correct the configuration of the plant as shown on plant drawings.

The staff reviewed the applicant's supplemental response to RAI 2.1-3, and determined that the applicant had described a process that would ensure that all abandoned equipment, that could potentially contain fluids and is in the proximity of safety-related SSCs, would be identified and drained.

By letter dated March 9, 2012, the applicant provided a supplemental response to RAI 2.1-3. In its supplemental response the applicant stated that it completed the actions listed in its previous supplemental response to RAI 2.1-3 dated September 16, 2011, to ensure abandoned equipment is identified, isolated and drained. The applicant's supplemental response also stated the following:

> Abandoned equipment that could impact safety-related equipment was verified to be isolated and drained with the exception of components associated with the [s]ervice [w]ater [s]ystem intake crib air bubbler compressors, and the [m]iscellaneous [l]iquid [r]adwaste [s]ystem degasifier skid, miscellaneous waste evaporator skid, evaporator storage tank pumps, and primary water transfer pumps. The subject components are added to the scope of license renewal in accordance with 10 CFR 54.4(a)(2)….

The staff reviewed the applicant's response to RAI 2.1-3, and determined that the applicant had described and completed a process to ensure that all abandoned equipment, that could potentially contain fluids and located in the proximity of safety-related SSCs, was verified to be drained or included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff's concern described in RAI 2.1-3 is resolved.

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, the applicant's 10 CFR 54.4(a)(2) implementing documents, and license renewal drawings, and also performed plant walkdowns. The staff determined that the applicant did not include nonsafety-related relief valve drain lines within the vicinity of safety-related SSCs within the scope of license renewal. The staff's review determined that the function of a drain line is to pass fluid when required; therefore, the pipe should be included within the scope of license renewal and subject to an AMR, in accordance with 10 CFR 54.4(a)(2) for spatial interaction.

By letter dated March 30, 2011, the staff issued RAI 2.1-4. The RAI requested the applicant to provide details of the analysis performed and any conclusions, related to the review of the potentially fluid filled, nonsafety-related relief valve drain lines, located within the vicinity of safety-related SSCs, for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for spatial interaction. During the review of this issue, the staff asked that the applicant consider the extent of the condition and indicate if the review concludes that use of the scoping methodology precluded the identification of SSCs, which should have been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

In its response dated April 29, 2011, the applicant stated the following:

> FENOC has performed a review of potentially fluid filled, nonsafety-related relief valve drain lines, located within the vicinity of safety-related SSCs, for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for spatial interaction. The review resulted in identifying additional components for inclusion within the scope of license renewal. License renewal drawings were revised to highlight the additional components.

The staff reviewed the applicant’s response to RAI 2.1-4, along with the information contained in the LRA, and determined that the applicant described the process used to evaluate potentially fluid filled, nonsafety-related relief valve drain lines, located within the vicinity of safety-related SSCs, which had not been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff determined that the applicant re-evaluated the nonsafety-related relief valve drain lines, in the vicinity of safety-related SSCs, and included the nonsafety-related relief drain valves within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). In addition, the applicant supplemented the information in the LRA to include the required AMR information for the applicable systems. RAI 2.1-4 is resolved.

The staff determined that additional information would be required to complete the review of the applicant’s scoping methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, the applicant's 10 CFR 54.4(a)(2) implementing documents, and license renewal drawings, and also performed plant walkdowns. The staff determined that the applicant did not include nonsafety-related drip pans and retention area drain lines within the vicinity of safety-related SSCs within the scope of license renewal. The staffs review determined that the function of the drip pans and retention area drain lines is to contain or pass fluid when required and, therefore, should be included within the scope of license renewal and subject to an AMR, in accordance with 10 CFR 54.4(a)(2) for spatial interaction and 10 CFR 54.21.

In RAI 2.1-5 dated March 30, 2011, the staff requested the applicant to provide details of the analysis performed and any conclusions, related to the review of the potentially fluid filled, nonsafety-related drip pan and retention area drain lines, located within the vicinity of safety-related SSCs, for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for spatial interaction.

In its response dated April 29, 2011, the applicant stated the following:

> FirstEnergy Nuclear Operating Company (FENOC) has performed a review of potentially fluid filled, nonsafety-related drip pan[s] and retention area drain lines, located within the vicinity of safety-related SSCs, for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for spatial interaction. The review has considered extent of condition and identified additional SSCs for inclusion into the LRA. License renewal drawings were revised to highlight the additional components.

The staff reviewed the applicant’s response to RAI 2.1-5, along with the information contained in the LRA, and determined that the applicant described the process used to evaluate potentially fluid filled, nonsafety-related drip pan and retention area drain lines, located within the vicinity of safety-related SSCs, that had not been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff determined that the applicant had re-evaluated the nonsafety-related drip pan and retention area drain lines, in the vicinity of safety-related SSCs, and included the nonsafety-related relief drain valves within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). In addition, the applicant supplemented the information in the LRA to include the required AMR information for the applicable systems. The staff's concern described in RAI 2.1-5 is resolved.

The staff determined that additional information would be required to complete the review of the applicant’s scoping methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, the applicant's 10 CFR 54.4(a)(2) implementing documents, and license renewal drawings, and also performed plant walkdowns. During a plant walkdown, the staff observed a nonsafety-related domestic water valve and other nonsafety-related fluid filled SSCs located in the service water tunnel and in the vicinity of safety-related SSCs.

In RAI 2.1-6 dated March 30, 2011, the staff requested the applicant to provide a basis for not including the nonsafety-related components, which are within the vicinity of safety-related SSCs, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for spatial interaction. During the review of this issue, the staff asked the applicant to consider the extent of the condition and indicate if the review concludes that use of the scoping methodology precluded the identification of SSCs, which should have been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

In its response dated April 29, 2011, the applicant stated the following:

> Following the scoping and screening methodology audit walkdown, the license renewal boundary drawings were reviewed and walkdowns performed to identify nonsafety-related fluid filled SSCs located in the vicinity of safety-related systems, structures and components (SSCs) in areas of the station where the drawings did not clearly identify building boundaries. This extent-of-condition review identified additional piping and components located in the safety-related Service Water Tunnel that should have been included within the scope of license renewal. The piping and components identified are associated with the Demineralized Water Storage (DWS) System, the Fire Protection (FP) System, the Fuel Oil System (specifically, fire pump diesel fuel oil piping), and the Makeup Water Treatment (MWT) System.

The staff reviewed the applicant’s response to RAI 2.1-6, along with the information contained in the LRA, and determined that the applicant described the process used to evaluate nonsafety-related domestic water valve and other nonsafety-related fluid filled SSCs located in the service water tunnel, located within the vicinity of safety-related SSCs, that had not been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff determined that the applicant had re-evaluated the nonsafety-related domestic water valve and other nonsafety-related fluid filled SSCs located in the service water tunnel, in the vicinity of safety-related SSCs, and included the identified nonsafety-related SSCs within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). In addition, the applicant supplemented the information in the LRA to include the required AMR information for the applicable systems. RAI 2.1-6 is resolved.

2.1.4.2.3 Conclusion

On the basis of its review of the applicant's scoping process, discussions with the applicant, and review of the information provided in the response to RAIs 2.1-1, 2.1-2, 2.1-3, 2.1-4, 2.1-5, 2.1-6 and 2.1-7, the staff concludes that the applicant's methodology for identifying and including nonsafety-related SSCs, which 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 Title 10, Part 54.4(a)(3) of the Code of Federal Regulations

2.1.4.3.1 Summary of Technical Information in the Application

Pursuant to 10 CFR 54.4(a)(3), all SSCs relied on safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC's regulations to ensure that fire protection (10 CFR 50.48), environmental qualification (EQ) (10 CFR 50.49), pressurized thermal shock (PTS) (10 CFR 50.61), anticipated transients without scram (ATWS) (10 CFR 50.62), and station blackout (SBO) (10 CFR 50.63) are within the scope of license renewal. LRA Section 2.1.1.3, "Regulated Events Scoping Criteria," states that SSCs required for compliance with 10 CFR 54.4(a)(3) were identified through a review of CLB documents including the USAR, the fire hazards analysis report, the SBO NRC SER, and other docketed correspondence between FENOC and the staff.

Fire Protection. LRA Section 2.1.1.3.1, "Fire Protection (10 CFR 50.48)," describes the scoping of SSCs relied on safety analyses or plant evaluations to perform a function that demonstrates compliance with the fire protection criterion. The LRA states that CLB was reviewed to identify SSCs required for compliance with the fire protection criterion. The LRA states that features required for fire protection of safety-related equipment and system functions necessary for the safe shutdown paths credited for compliance with 10 CFR Part 50, Appendix R, were identified. The LRA also states that SSCs relied on to perform a function for fire protection were included within the scope of license renewal.

Environmental Qualification. LRA Section 2.1.1.3.2, "Environmental Qualification (10 CFR 50.49)," describes the scoping of systems and structures relied on safety analyses or plant evaluations to perform a function in compliance with the EQ rule. The LRA states that EQ applies to safety-related and nonsafety-related electrical components installed in mechanical systems, as well as in electrical and instrumentation and control (I&C) systems, that perform an intended function for accident mitigation, post-accident monitoring, and safe shutdown. The LRA states that a review of the CLB for EQ was performed, and SSCs determined to perform an intended function pursuant to 10 CFR 50.49 were included within the scope of license renewal.

Pressurized Thermal Shock. LRA Section 2.1.1.3.3, "Pressurized Thermal Shock (10 CFR 50.61)," describes the scoping of SSCs relied on safety analyses or plant evaluations to perform a function that demonstrates compliance with the PTS rule. The LRA states that a review of docketed licensing correspondence and related technical reports identified the RCS and the RV as the only system and component within the scope of license renewal for PTS.

Anticipated Transients Without Scram. LRA Section 2.1.1.3.4, "Anticipated Transients Without Scram (10 CFR 50.62)," describes the scoping of SSCs relied on safety analyses or plant evaluations to perform a function that demonstrates compliance with the ATWS rule. The LRA states that a complete loss of main feedwater and a loss of offsite power are the ATWS transients of concern for Davis-Besse. The LRA states that Davis-Besse plant-specific design is in compliance with the ATWS rule and consist of two elements—the steam and feedwater rupture control system and the diverse scram system. The LRA also states that both of these ATWS mitigation systems were included within the scope of license renewal as electrical and I&C systems.

Station Blackout. LRA Section 2.1.1.3.5, “Station Blackout (10 CFR 50.63),” describes the scoping of SSCs relied on safety analyses or plant evaluations to perform a function that demonstrates compliance with the SBO rule. The LRA states that, with the addition of the station blackout diesel generator (SBODG), Davis-Besse complies with the SBO rule. The LRA states that plant equipment relied upon for compliance with 10 CFR 50.63 and SSCs relied upon to restore offsite alternating current (AC) power and onsite AC for an SBO event were identified and included within the scope of license renewal.

2.1.4.3.2 Staff Evaluation

Pursuant to 10 CFR Part 54.4(a)(3), the applicant must consider all SSCs relied on safety analyses or plant evaluations to perform a function that demonstrates compliance with the NRC’s regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), PTS (10 CFR 50.61), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63). As part of this review, the staff discussed the applicant's methodology and reviewed the boundary scoping drawings and the LRA for the development and approach taken to complete the scoping process for these regulated safety systems. The staff also evaluated SSCs (on a sampling basis) included within the scope of license renewal pursuant to 10 CFR 54.4(a)(3).

The staff confirmed that the applicant’s implementing procedures were used for identifying Davis-Besse SSCs within the scope of license renewal pursuant to 10 CFR 54.4(a)(3). The applicant evaluated the Davis-Besse CLB to identify SSCs that perform functions addressed in 10 CFR 54.4(a)(3), “Regulated Events,” and included these SSCs within the scope of license renewal as documented in the Davis-Besse scoping report. The staff determined that the scoping report results reference the information sources used for determining the SSCs credited for compliance with the events listed in the specified regulations for the applicable license renewal regulated events.

Fire Protection. The staff determined that the applicant’s scoping report identified SSCs in the scope of license renewal required for fire protection using CLB documents, primarily the fire hazards analysis report. The applicant used the system description for fire protection for design and licensing basis considerations for the fire protection system. The staff reviewed the scoping results, on a sampling basis, in conjunction with the LRA and the CLB information, to validate the methodology for including the appropriate SSCs within the scope of license renewal. The staff determined that the applicants scoping included SSCs that perform intended functions to meet the requirements of 10 CFR 50.48. Based on its review of the CLB documents and the sample review, the staff determined that the applicant’s scoping methodology was adequate for including SSCs credited in performing fire protection functions within the scope of license renewal.

Environmental Qualification. The staff confirmed that the applicant’s scoping document required the inclusion of safety-related electrical equipment, nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishments of safety functions of the safety-related equipment, and certain post-accident monitoring equipment, as defined in 10 CFR 50.49(b)(1), 50.49(b)(2), and 50.49(b)(3). The staff determined that the applicant used the CLB to identify SSCs necessary to meet the requirements of 10 CFR 50.49. The Davis-Besse configuration database contains the EQ identifications for specific components. The staff reviewed the LRA, applicant's implementing procedures, and scoping report to verify that the applicant identified SSCs within the scope of license renewal that meet EQ requirements. Based on that review, the staff determined that the applicant's scoping methodology is adequate for identifying EQ SSCs within the scope of license renewal.

Pressurized Thermal Shock. The staff confirmed that the applicant's scoping document described the use of Davis-Besse CLB information to review the activities performed to meet 10 CFR 50.61, "PTS Rule," which resulted in the Davis-Besse reactor coolant system (RCS) and reactor vessel (RV) being within the scope of license renewal, pursuant to 10 CFR 54.4(a)(3). The staff reviewed the scoping report 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 included the 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 staff determined that the applicant's scoping report in regard to ATWS included the plant systems credited for ATWS mitigation based on review of the Davis-Besse CLB. The staff reviewed the LRA in conjunction with the scoping results to validate the methodology for identifying ATWS systems and structures that are within the scope of license renewal. The staff determined that the scoping results included systems and structures that perform intended functions meeting 10 CFR 50.62 requirements. The staff determined that the applicant's scoping methodology was adequate for identifying SSCs with functions credited for complying with the ATWS regulation.

Station Blackout. The staff determined that the applicant's scoping report included SSCs, determined from the Davis-Besse CLB, that the applicant identified were associated with coping and safe shutdown of the plant following an SBO event by reviewing the USAR, drawings, plant configuration database, and plant procedures. The staff reviewed the LRA in conjunction with the scoping results to validate the applicant's methodology. The staff finds that the scoping results included systems and structures that perform intended functions meeting 10 CFR 50.63 requirements. The staff determined that the applicant's scoping methodology was adequate for identifying SSCs credited in complying with the SBO regulation within the scope of license renewal.

2.1.4.3.3 Conclusion

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

2.1.4.4 Plant-Level Scoping of Systems and Structures

2.1.4.4.1 Summary of Technical Information in the Application

LRA Section 2.1.1, "Scoping Methodology," describes the methodology used for the license renewal scoping of systems and structures, pursuant to 10 CFR 54.4(a). The LRA states that SSCs were determined to be within the scope of license renewal following the guidance of NEI 95-10. The LRA states that the scoping process established a listing of plant systems and structures whose functions meet the criteria of 10 CFR 54.4(a). The LRA also states that systems and structures performing those functions are included within the scope of license renewal. The LRA further states that the scoping process included a review of the following design basis information sources and documents:

- Davis-Besse USAR
- Davis-Besse SERs
- Davis-Besse docketed information sources
- Design Criteria Manual
- MRPM
- system description document
- plant engineering drawings
- piping calculations
- plant procedures
- DBE information
- other controlled information sources

2.1.4.4.2 Staff Evaluation

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

The applicant documented the results of the plant-level scoping process in accordance with the implementing documents. The results were provided in the systems and structures documents and reports, which contained information to include the following:

- a description of the structure or system
- a listing of functions performed by the system or structure
- identification of intended functions
- the 10 CFR 54.4(a) scoping criteria met by the system or structure
- references
- 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 concluded that the applicant's scoping results contained an appropriate level of detail to document the scoping process.

2.1.4.4.3 Conclusion

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

2.1.4.5 Mechanical Component Scoping

2.1.4.5.1 Summary of Technical Information in the Application

LRA Section 2.1.1, “Scoping Methodology,” states that SSCs were determined to be within the scope of license renewal following the guidance of NEI 95-10. The LRA states that the scoping process established a listing of plant systems and structures whose functions meet the criteria of 10 CFR 54.4(a). The LRA also states that systems and structures performing those functions are included within the scope of license renewal. The LRA also states that a list of mechanical systems within the scope of license renewal was developed from a review of the MRPM, the USAR, and system description documents.

LRA Section 2.1.1.4, “Scoping Boundary Determination,” states that system and structure evaluation boundaries define the portions of a system or structure necessary to ensure performance of an intended function and identify those components that are within the scope of license renewal. The LRA states that components that support an intended function identified in the scoping process as well as all safety-related components are considered to be within the scope of license renewal and are included within the evaluation boundaries. The LRA also states that those components that do not support an intended function are outside the evaluation boundaries and, therefore, are not within the scope of license renewal.

LRA Section 2.1.1.4.1, “Mechanical Systems,” states that the mechanical systems evaluation boundaries are illustrated on piping P&IDs by highlighting the portions of the systems that are within the scope of license renewal pursuant to 10 CFR 54.4(a).

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.1, 2.1.1.4, and 2.1.1.4.1, and the guidance contained in the applicant's implementing procedures and reports, to perform the review of the mechanical scoping process. The project documents and reports provided instructions for identifying the evaluation boundaries. The staff reviewed the applicant's implementing documents and the CLB documents associated with mechanical system scoping and determined 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 personnel and reviewed documentation pertinent to the scoping process. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure was consistent with the description provided in the LRA Sections 2.1.1 and 2.1.1.4 and the guidance contained in the SRP-LR, Section 2.1, and that the applicant's procedure was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping reports for the service water, EDGs and support systems, main feedwater, and AFW and mechanical component types that met the scoping criteria of 10 CFR 54.4. The staff also reviewed the applicant's implementing procedures and discussed the methodology and results with the applicant. The staff confirmed that the applicant identified and used pertinent engineering and licensing information to determine that the mechanical components of the service water system, EDGs and support systems, main feedwater system, and AFW system are required to be within the scope of license renewal. As part of the review process, the staff evaluated each system’s intended functions, the basis for inclusion of the intended function, and the process used to identify each of the system component types. The staff confirmed that the applicant had identified and highlighted system P&IDs to develop the license renewal boundaries in accordance with the procedural guidance. Additionally, the staff determined that the applicant independently confirmed the results in accordance with the governing procedures. The staff confirmed that the applicant had license renewal personnel knowledgeable about the system, that these personnel performed independent reviews of the marked-up drawings to ensure accurate identification of system intended functions, and that the applicant performed additional cross-discipline verification and independent reviews of the resultant highlighted drawings before final approval of the scoping effort.

As part of this review, the staff discussed the methodology with the applicant, reviewed the applicant's implementing procedures developed to support the review, and evaluated the scoping results for a sample of SSCs that were identified as being within the scope of license renewal. The staff determined that, for the mechanical systems reviewed on a sampling basis, the applicant included the mechanical systems within the scope of license renewal, in accordance with the 10 CFR 54.4(a) criteria.

2.1.4.5.3 Conclusion

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

2.1.4.6 Structural Component Scoping

2.1.4.6.1 Summary of Technical Information in the Application

LRA Section 2.1.1, “Scoping Methodology,” states that SSCs were determined to be within the scope of license renewal following the guidance of NEI 95-10. The LRA states that the scoping process established a listing of plant systems and structures whose functions meet the criteria of 10 CFR 54.4(a). The LRA also states that systems and structures performing those functions are included within the scope of license renewal. The LRA also states that a list of structures within the scope of license renewal was developed from a review of the MRPM, the USAR, and architectural arrangement and civil drawings.

LRA Section 2.1.1.4, “Scoping Boundary Determination,” states that system and structure evaluation boundaries define the portions of a system or structure necessary to ensure performance of an intended function and identify those components that are within the scope of license renewal. The LRA states that components that support an intended function identified in the scoping process as well as all safety-related components are considered to be within the scope of license renewal and are included within the evaluation boundaries. The LRA also states that those components that do not support an intended function are outside the evaluation boundaries and, therefore, are not within the scope of license renewal.

LRA Section 2.1.1.4.2, "Structures," states that, "[t]he evaluation boundary of an in-scope structure is the structure itself and the structural commodities within that structure, unless noted otherwise."

2.1.4.6.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.1 and 2.1.1.4.2, and the guidance contained in the applicant's implementing procedures and reports to perform the review of the structural scoping process. The license renewal procedures provided instructions for identifying the evaluation boundaries. The staff reviewed the applicant's approach to identifying structures relied upon to perform the functions described in 10 CFR 54.4(a). As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the review, and evaluated the scoping results for a sample of structures that were identified within the scope of license renewal. The staff determined that the applicant identified and developed a list of plant structures and the structures intended functions through a review of the USAR, plant equipment database, CLB documentation, documents, procedures, and drawings. As part of the review process, the staff evaluated the intended functions identified for the turbine building, and the structural components within, the basis for inclusion of the intended function, and the process used to identify each of the component types. Each structure the applicant identified was evaluated against the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3). The staff confirmed that the applicant identified and used pertinent engineering and licensing information in order to determine that appropriate structures were included within the scope of license renewal.

As part of this review, the staff discussed the methodology with the applicant, reviewed the applicant's implementing procedures developed to support the review, and evaluated the scoping results for a sample of SSCs that were identified as being within the scope of license renewal. The staff determined that, for the structure and structural components reviewed on a sampling basis, the applicant included the structures and structural components within the scope of license renewal, in accordance with the 10 CFR 54.4(a) criteria.

2.1.4.6.3 Conclusion

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

2.1.4.7 Electrical Component Scoping

2.1.4.7.1 Summary of Technical Information in the Application

LRA Section 2.1.1, "Scoping Methodology," states that SSCs were determined to be within the scope of license renewal following the guidance of NEI 95-10. The LRA states that the scoping process established a listing of plant systems and structures whose functions meet the criteria of 10 CFR 54.4(a). The LRA states that systems and structures performing those functions are included within the scope of license renewal. The LRA also states that a list of electrical systems within the scope of license renewal was developed from a review of the MRPM, the USAR, and system description documents.

LRA Section 2.1.1.4, "Scoping Boundary Determination," states that system and structure evaluation boundaries define the portions of a system or structure necessary to ensure performance of an intended function and identify those components that are within the scope of license renewal. The LRA states that components that support an intended function identified in the scoping process as well as all safety-related components are considered to be within the scope of license renewal and are included within the evaluation boundaries. The LRA also states that those components that do not support an intended function are outside the evaluation boundaries and, therefore, are not within the scope of license renewal.

LRA Section 2.1.1.4.3, "Electrical and Instrumentation and Control Systems," states that all I&C systems are included within the scope of license renewal unless they are scoped out. The LRA states that mechanical systems are included within the electrical evaluation boundary when I&C components support their only license renewal function. The LRA also states that the electrical evaluation boundaries are depicted relative to the I&C systems and components necessary to define the SBO boundary.

2.1.4.7.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.1 and 2.1.1.4.3 and the guidance contained in the applicant's implementing procedures and reports to perform the review of the electrical scoping process. The staff reviewed the applicant's approach to identifying I&C SSCs relied upon to perform the functions described in 10 CFR 54.4(a). The staff reviewed portions of the documentation used by the applicant to perform the electrical scoping process including the USAR, plant equipment database, CLB documentation, documents, procedures, drawings, specifications, and codes and standards.

The staff noted that, after the scoping of electrical and I&C components was performed, the in-scope electrical components were categorized into electrical component types. Component types include similar electrical and I&C components with common characteristics and that component level intended functions of the component types were identified, such as cable, switchyard bus, transmission conductors, high-voltage insulators, and connections.

As part of this review, the staff discussed the methodology with the applicant, reviewed the applicant's implementing procedures developed to support the review, and evaluated the scoping results for a sample of SSCs that were identified within the scope of license renewal. The staff determined that the applicant had, for the electrical and I&C components reviewed on a sampling basis, included the electrical and I&C components and also electrical and I&C components contained in mechanical or structural systems within the scope of license renewal on a commodity basis, in accordance with the 10 CFR 54.4(a) criterion.

2.1.4.7.3 Conclusion

On the basis of its review of information contained in the LRA, scoping implementing procedures, 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 complies with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.8 Conclusion for Scoping Methodology

On the basis of its review of the LRA, implementing procedures, and a sampling review of scoping results, the staff concludes that the applicant's scoping methodology was consistent with the guidance contained in the SRP-LR. Additionally, it identified, and included within the scope of license renewal, those SSCs meeting the criteria of 10 CFR 54.4(a)(1), 54.4(a)(2) or 54.4(a)(3). The staff concluded that the applicant's methodology is consistent with the requirements of 10 CFR 54.4(a) and, therefore, is acceptable.

2.1.5 Screening Methodology

2.1.5.1 General Screening Methodology

2.1.5.1.1 Summary of Technical Information in the Application

Pursuant to 10 CFR 54.21(a), for SSCs within the scope of license renewal the applicant must identify and list those SCs subject to an AMR. LRA Section 2.1.2, "Screening Methodology," states that screening is the process of identifying SCs subject to an AMR. The LRA states that in order to identify passive SCs during the screening process, the guidance in SRP-LR and NEI 95-10 was used. The LRA also states that the screening processes for SCs within the mechanical, structural, and electrical disciplines met the requirements of 10 CFR 54.21(a).

2.1.5.1.2 Staff Evaluation

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

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

The staff determined that the screening process evaluated the component types and commodity groups, included within the scope of license renewal, to determine which ones were long-lived and passive and, therefore, subject to an AMR. The staff reviewed LRA Section 2.3, "Scoping and Screening Results: Mechanical Systems," LRA Section 2.4, "Scoping and Screening Results: Structures," and LRA Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems." These sections of the LRA provided the results of the process used to identify component types and commodity groups subject to an AMR. The staff also reviewed, on a sampling basis, the screening results reports for the service water, EDGs and support systems, main feedwater, AFW systems, and the turbine 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 methodologies for mechanical, structural, and electrical are discussed in SER Sections 2.1.5.2, 2.1.5.3, and 2.1.5.4, respectively.

2.1.5.1.3 Conclusion

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

2.1.5.2 Mechanical Component Screening

2.1.5.2.1 Summary of Technical Information in the Application

LRA Section 2.1.2.1.1, "Identifying Mechanical Components Subject to Aging Management Review," discusses the screening methodology for identifying passive and long-lived mechanical components that are subject to an AMR. The LRA states that passive, long-lived components that support system intended functions and are within the evaluation boundaries are subject to an AMR.

LRA Section 2.1.2.1.2, "Mechanical Component Intended Functions," states that a component intended function was the specific simple function that supported the broader system function. The LRA states that functions such as maintaining pressure boundary integrity, providing heat transfer, filtration, and flow control were identified as intended functions for mechanical components.

2.1.5.2.2 Staff Evaluation

The staff reviewed the mechanical screening methodology discussed and documented in LRA Section 2.1.2.1.1, applicant's implementing documents, scoping and screening reports, and license renewal drawings. The staff determined that the mechanical system screening process began with the results from the scoping process and that the applicant reviewed each system evaluation boundary as depicted on the P&IDs to identify passive and long-lived components. Additionally, the staff determined that the applicant identified all passive and long-lived components that perform or support an intended function within the system evaluation boundaries and determined those components to be subject to an AMR. The results of the review were documented in the scoping and screening reports, which contain information such as the information sources reviewed and the component's intended functions.

The staff confirmed 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 confirmed that the applicant reviewed the components within the system intended function boundary to determine if the component supported the system intended function and that those components that supported the system intended function were reviewed to determine if the component was passive and long-lived and, therefore, subject to an AMR.

The staff reviewed selected portions of the USAR, plant equipment database, CLB documentation, Davis-Besse databases and documents, procedures, drawings, specifications, and selected scoping and screening reports. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff also performed a walkdown of portions of the selected systems with plant engineers to verify documentation. 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 with the applicant and, on a sampling basis, reviewed the applicant's screening reports for the service water, EDGs and support systems, main feedwater, and AFW systems to verify proper implementation of the screening process.

The staff determined that additional information would be required to complete the review of the applicant's screening methodology. During the scoping and screening methodology audit, performed onsite January 24–28, 2011, the staff reviewed the LRA, selected AMR documents and license renewal drawings, and performed plant walkdowns. The staff determined, through a review of the service water AMR documentation, that the service water pump bolts were excluded from the scope of license renewal based on periodic replacement. However, the AMR documentation indicated that a visual inspection was also used to determine whether bolt replacement would be required. The staff determined that the use of inspection activities to determine the need to replace a component did not meet the requirements of 10 CFR 54.21 (a)(1)(ii), replacement based on a qualified life or specified time period.

In RAI 2.1-8, dated March 30, 2011, the staff requested the applicant to provide details of the analysis performed and any conclusions, related to the review of service water pump bolts, for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff requested the applicant to review the issue, consider extent of condition, and indicate if the review concludes that use of the scoping methodology precluded the identification of SSCs that should have been included within the scope of license renewal in accordance with 10 CFR 54.4(a).

In its response dated April 29, 2011, the applicant stated the following:

> LRA Section 2.3.3.26, page 2.3-129, provided the following:
>
> > The bolting in the service water pumps and dilution pump (DB-P3-1 through 3 and DB-P180) is within the scope of license renewal. However, in the process of rebuilding the pumps, the bolting is inspected and repaired or replaced as necessary. As such the pump bolting is evaluated as short-lived, subject to replacement based on a qualified life or specified time period, and is not subject to [an] AMR.
>
> The bolts associated with the service water pumps and dilution pump (DB-P3-1 through 3 and DB-P180) are replaced as necessary but not on a qualified life basis or a specified time period. Therefore, the subject bolts are within the scope of license renewal in accordance with 10 CFR 54.4(a) and are subject to [an] aging management review (AMR) in accordance with 10 CFR 54.21(a) on the basis that they perform a license renewal intended function and are not replaced on a qualified life basis or a specified time period.

> The aging management review (AMR) for the bolts associated with the service water pumps (DB-P3-1, 2, and 3) and dilution pump (DB-P180) has been revised and the steel bolting was evaluated for a raw water external environment since the pumps are submerged in water supplied by Lake Erie. The AMR results are provided in revised LRA Table 3.3.2-26.…
>
> An extent of condition was conducted relative to components within the scope of license renewal and determined as “not subject to an AMR” based upon replacement. AMR reports were reviewed to identify components that were “not subject to [an] AMR” based upon replacement. There were no other components that were determined as “not subject to [an] AMR” due to replacement, where the replacement was based upon an inspection versus a specified time period.
>
> In addition, the license renewal AMR project instruction provides that components subject to refurbishment or replacement solely on the basis of condition (e.g., the component is replaced only if significant degradation is observed during a periodic inspection), are still considered long-lived and require an AMR.
>
> No additional scoping evaluations were required to address the 10 CFR 54.4(a) or 10 CFR 54.21(a) criteria. Also, no changes were required to the Davis-Besse license renewal scoping and screening methodology.

The staff reviewed the applicant’s response to RAI 2.1-8, along with the information contained in the LRA, and determined that the applicant had re-evaluated the initial determination that the service water pump bolts were replaced based on a qualified life or specified time period and therefore not subject to an AMR in accordance with 10 CFR 54.21. The applicant further determined that since the bolts were replaced, in part, on the basis of inspection results, the bolt replacement was not based solely on a qualified life or specified time period and, therefore, was subject to an AMR. As a result of the re-evaluation, the applicant performed the AMR and identified an appropriate AMP that would be applied to the service water pump bolts. The staff concluded that the applicant appropriately identified the service water pump bolts as a passive, long-lived component in accordance with 10 CFR 54.21, performed the AMR, and identified the applicable AMP. In addition, the applicant supplemented the information in the LRA to include the required AMR information for the applicable systems. RAI 2.1-8 is resolved.

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

The staff reviewed the LRA, the screening implementation procedures, selected portions of the USAR, plant equipment database, CLB documentation, procedures, drawings, specifications, selected scoping and screening reports, and a sample of the service water, EDGs and support systems, main feedwater, and AFW systems. Based on its review, the staff concludes that the applicant’s methodology for identification of mechanical components within the scope of license renewal and subject to an AMR complies with the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.3 Structural Component Screening

2.1.5.3.1 Summary of Technical Information in the Application

LRA Section 2.1.2.2.1, "Identifying Structural Components Subject to Aging Management Review," states that passive long-lived structural components and commodities determined to perform an intended function were identified as subject to an AMR. The LRA states that the structural screening process involved a review of the USAR, Design Criteria Manual, drawings, and other licensing basis documents to identify the structural components and commodities that made up the structure. The LRA states that in order to categorize structural components and commodities for AMR the structural components and commodities were first grouped based on material of construction and then subdivided based on component design and function.

LRA Section 2.1.2.2.2, "Structural Commodity Intended Functions," states that a simple set of intended functions were applied to both the structures and its components. The LRA states that the guidance in NEI 95-10 was followed to determine the intended functions of structural components and commodities for license renewal.

2.1.5.3.2 Staff Evaluation

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

The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process to assess if the screening methodology outlined in the LRA and applicant's implementing procedures were appropriately implemented and if the scoping results were consistent with CLB requirements.

During the scoping and screening methodology audit, the staff reviewed, on a sampling basis, the applicant's screening reports for various structures and bulk structural commodities to verify proper implementation of the screening process. The staff also walked down the turbine building as part of their reviews. 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, implementing procedures, and a sampling of structural screening results, the staff concludes that the applicant's methodology for identification of structural components within the scope of license renewal and subject to an AMR complies 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 2.1.2.3.1, "Identifying Electrical Commodities Subject to Aging Management Review," states that the screening process of electrical components was performed by grouping components by component type and evaluating them in their commodity groups. The LRA states that a list of electrical component commodity group was generated, and electrical components within the groups were identified as subject to an AMR. The LRA also states that the screening process was based on NEI 95-10, Appendix B guidance.

LRA Section 2.1.2.3.2, "Electrical Commodity Intended Functions," states that the intended function of electrical commodities was determined. The LRA states that NEI 95-10 guidance was used to identify the intended functions of electrical commodities.

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant's methodology used for electrical component screening in LRA Section 2.1.2.3, the applicant's implementing procedures, basis documents, and the electrical screening report. The staff confirmed that the applicant used the screening process described in these documents, along with the information contained in NEI 95-10, Appendix B, and the SRP-LR, to identify the electrical and I&C components subject to an AMR.

The staff determined that the applicant identified commodity groups that were found to meet the passive criteria in accordance with NEI 95-10. In addition, the staff determined that the applicant evaluated the identified passive commodities to identify whether they were subject to replacement based on a qualified life or specified time (short-lived) or not subject to replacement based on a qualified life or specified time (long-lived) and that the remaining passive, long-lived components were determined to be subject to an AMR.

The staff performed a review to determine if the screening methodology outlined in the LRA and applicant's implementing procedures were appropriately implemented. During the scoping and screening methodology audit, the staff reviewed the screening report and discussed the report with the applicant 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.

2.1.5.4.3 Conclusion

On the basis of its review of the LRA, the screening implementation procedure, drawings, discussion with the applicant, and a sample of the results of the screening methodology, the staff concludes that the applicant's methodology for identification of electrical components within the scope of license renewal and subject to an AMR complies with the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.5 Conclusion for Screening Methodology

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

2.1.6 Summary of Evaluation Findings

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

2.2 Plant-Level Scoping Results

2.2.1 Introduction

LRA Section 2.1 describes the methodology for identifying SSCs within the scope of license renewal. In LRA Section 2.2, the applicant used the scoping methodology to determine which SSCs must be included within the scope of license renewal.

The staff reviewed the plant-level scoping results to determine if the applicant properly identified the following 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 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 Tables 2.2-1, 2.2-2, and 2.2-3 list plant mechanical systems, electrical and I&C systems, and structures that are within the scope of license renewal. Also in LRA Tables 2.2-1, 2.2-2, and 2.2-3, 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 plant's CLB, other CLB information relating to nonsafety-related systems and structures, and certain regulated events, the applicant identified plant-level systems and structures within the scope of license renewal, as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

In LRA Section 2.1, the applicant described its methodology for identifying systems and structures within the scope of license renewal and subject to an AMR. The staff reviewed the scoping and screening methodology and provides its evaluation in SER Section 2.1. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results shown in LRA Table 2.2-1, "License Renewal Scoping Results for

Mechanical Systems," LRA Table 2.2-2, "License Renewal Scoping Results for Electrical and I&C Systems" and LRA Table 2.2-3, "License Renewal Scoping Results for Structures" to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

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

In RAI 2.2-01, dated March 18, 2011, the staff noted that LRA Tables 2.2-1, 2.2-2, and 2.2-3 provide the results of applying the license renewal scoping criteria to the systems, structures, and commodities. The license renewal scoping criteria was described in Section 2.1. The USAR systems shown in Table 2.2-1 could not be located in LRA Tables 2.2-1, 2.2-2, or 2.2-3.

Table 2.2-1. USAR Systems not located in LRA Tables 2.2-1, 2.2-2, or 2.2-3

USAR section	System
5.2.6—Loose parts monitoring	Loose parts monitoring system
9.2.4.2—System description	Domestic water system
10.4.8—Steam generator (SG) blow down system	SG blowdown system
11.5—Solid waste system	Solid waste system
9.1.4—Fuel handling system	Fuel handling system

The applicant was requested to justify its exclusion of the above systems in Tables 2.2-1, 2.2 2, or 2.2-3.

In its response dated April 15, 2011, the applicant provided the following explanations as to why the requested systems were not included in Tables 2.2-1, 2.2-2, or 2.2-3.

- The loose parts monitoring system is evaluated as part of the miscellaneous subsystems.
- The domestic water system is evaluated as part of the makeup water treatment (MWT) system.
- The SG blowdown system is evaluated as part of the main steam system.
- The solid waste system is evaluated as part of the spent resin transfer system.
- The fuel handling system is evaluated as structural components as part of in-scope auxiliary building and containment structures.

Based on its review, the staff finds the applicant's response to RAI 2.2-01 acceptable because the reviewed systems were not excluded from the LRA, rather they are evaluated within systems included in Table 2.2-1, Table 2.2-2, or Table 2.2-3. Therefore, the staff's concern described in RAI 2.2-01 is resolved.

2.2.4 Conclusion

The staff reviewed LRA Section 2.2, RAI 2.2-01 response, and the USAR's supporting information to determine whether the applicant identified all systems and structures within the scope of license renewal. On the basis of its review, the staff concludes that the applicant appropriately identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4.

2.3 Scoping and Screening Results: Mechanical Systems

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

- RV, internals, RCS and RCPB, and SGs
- engineered safety features (ESF) systems
- auxiliary systems
- steam and power conversion systems

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs that are 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 the mechanical system SCs that met the scoping criteria and were subject to an AMR, confirming that there were no omissions.

The staff's evaluation of mechanical systems was performed using the evaluation methodology described in SRP-LR Section 2.3 and took into account the system function(s) described in the USAR. 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 are subject to an AMR, as required by 10 CFR 54.21(a)(1).

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

For those SCs with intended functions delineated under 10 CFR 54.4(a), the staff confirmed the applicant properly screened out only SCs that have functions performed with moving parts or a change in configuration or properties or 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's evaluation of the mechanical system scoping and screening results applies to all mechanical systems reviewed. Those systems that required RAIs to be generated (if any) include an additional staff evaluation, which specifically addresses the applicant's responses to the RAI(s).

2.3.1 Reactor Vessel, Internals, Reactor Coolant System and Reactor Coolant Pressure Boundary, and Steam Generators

LRA Section 2.3.1 identifies the RV, internals, RCS and RCPB, and SG SCs subject to an AMR for license renewal.

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

- LRA Section 2.3.1.1, "Reactor Pressure Vessel"
- LRA Section 2.3.1.2, "Reactor Vessel Internals"
- LRA Section 2.3.1.3, "Reactor Coolant System and Reactor Coolant Pressure Boundary"
- LRA Section 2.3.1.4, "Steam Generators"

2.3.1.1 Reactor Pressure Vessel

2.3.1.1.1 Summary of Technical Information in the Application

The reactor pressure vessel (RPV) is designed to contain the reactor coolant and facilitate the transfer of heat from the core. The vessel provides a floodable volume to assure adequate core cooling in the event of a breach in the coolant boundary external to the RPV. The purpose of the RPV is to form part of the reactor coolant boundary and to serve as a radioactive material barrier during normal operations and following abnormal operational transients and accidents. The RPV also provides support for RCS piping, control rod drive mechanisms, control rods, and incore detectors.

The RPV contains the reactor core, the reactor internals, and reactor core coolant moderator. The RPV consists of the following major components: the cylindrical shell and flange, the top head and flange, the bottom head, welds, nozzles, safe ends, pressure boundary bolting, RPV insulation, internal supports, and external supports.

LRA Table 2.3.1-1 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.1.1.3 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 that the applicant appropriately identified the RPV components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the RPV components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel Internals

2.3.1.2.1 Summary of Technical Information in the Application

The reactor vessel internals (RVI) system is a mechanical system whose components are contained within the RPV and extend beyond the RPV to form a portion of the reactor coolant boundary.

The purpose of the RVI is to provide support for the core and other internal components, maintain the fuel in a coolable geometry during normal and accident conditions, provide proper distribution of the coolant delivered to the vessel, provide a floodable volume, and maintain the RCPB.

The RVI consist of the core support assembly and the plenum assembly. The core support assembly includes the core barrel assembly, core support shield assembly, flow distributor assembly, incore instrument guide tube assemblies, thermal shield assembly, lower grid assembly, surveillance specimen holder tubes, and vent valve assemblies. The plenum assembly includes the control rod guide tube assemblies, the plenum cover assembly, the plenum cylinder assembly, and the upper grid assembly.

LRA Table 2.3.1-2 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.1.2.3 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 that the applicant appropriately identified the RVI system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the RVI system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.3 Reactor Coolant System and Reactor Coolant Pressure Boundary

2.3.1.3.1 Summary of Technical Information in the Application

The RCS and RCPB is a normally operating system designed to circulate subcooled reactor coolant to transfer heat from the reactor core to the secondary fluid in two SGs during normal operation and anticipated operational occurrences. The system is capable of transferring heat using forced circulation with the reactor coolant pumps (RCPs) during normal operation, or using natural circulation when necessary during emergency operations. The RCS also provides containment isolation and is a barrier against the release of radioactive material to the environment.

The RCS consists of the following major components: the RPV, two vertical once-through SGs, four shaft-sealed RCPs, an electrically heated pressurizer, and interconnecting piping. In addition to serving as a heat transport medium, the coolant also serves as a neutron moderator and reflector and as a solvent for the soluble poison (boron in the form of boric acid) used in chemical shim reactivity control.

In addition to the RCS, the RCPB includes the RPV flange leak detection piping, the incore monitoring system piping, and the Class 1 (Code Group A) portions of the core flooding system, decay heat removal (DHR) and low-pressure injection system, high-pressure injection (HPI) system, makeup and purification system, nitrogen system, and sampling system.

LRA Table 2.3.1-3 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.1.3.3 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 that the applicant appropriately identified the RCS and RCPB components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the RCS and RCPB components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.4 Steam Generators

2.3.1.4.1 Summary of Technical Information in the Application

The SGs are vertical, straight-tube-and-shell heat exchangers that produce superheated steam at approximately a constant pressure over the power range. The purposes of the SGs are to transfer heat from the reactor coolant to the main feedwater via the two once-through design SGs during normal operation and anticipated operational occurrences so that reactor core thermal limits are not exceeded, to provide a pressure boundary to separate fission products from the environment, and to provide containment isolation.

LRA Table 2.3.1-4 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.1.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.4 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.1.4.3 Conclusion

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

2.3.2 Engineered Safety Features

LRA Section 2.3.2 identifies the ESF SCs subject to an AMR for license renewal.

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

- LRA Section 2.3.2.1, “Containment Air Cooling and Recirculation System”
- LRA Section 2.3.2.2, “Containment Spray System”
- LRA Section 2.3.2.3, “Core Flooding System”
- LRA Section 2.3.2.4, “Decay Heat Removal and Low-Pressure Injection System”
- LRA Section 2.3.2.5, “High-Pressure Injection System”

2.3.2.1 Containment Air Cooling and Recirculation System

2.3.2.1.1 Summary of Technical Information in the Application

The containment air cooling and recirculation system is composed of the containment air cooling system and the containment recirculation system. The containment air cooling system is composed of three air cooler units located within the containment vessel. The system is designed to control the containment vessel ambient air temperature to a maximum of 120 degrees Fahrenheit with two of the three units operating. The containment air cooling system is composed of three parallel trains, each with an air cooler unit, ductwork, and backdraft dampers, discharging to a common distribution system. The system is used for both normal and emergency cooling. Each air cooler unit consists of a finned tube cooling coil and a direct drive two speed fan. The containment air cooling system provides cooling by recirculation of the containment vessel air across air-to-water heat exchangers. The containment air cooler fans pull the air through the cooling coils where heat is transferred from the air to the cooling water (supplied by the service water system) in the tubes.

The containment recirculation system consists of two trains, each with a direct drive, vane axial fan, ductwork, and dampers. The fans circulate the air in the containment dome to the vicinity of the containment air cooling system inlets. This action helps prevent temperature stratification in the containment.

The intended functions of the containment air cooling and recirculation system within the scope of license renewal include the following:

- maintain post-accident containment temperature and pressure within the design limits
- remove heat from the containment atmosphere to reduce pressure
- mix the post-loss-of-coolant accident (LOCA) containment atmosphere to prevent the formation of hydrogen pockets

LRA Table 2.3.2-1 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.2.1.3 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 that the applicant appropriately identified the containment air cooling and recirculation system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the containment air cooling and recirculation system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.2 Containment Spray System

2.3.2.2.1 Summary of Technical Information in the Application

The containment spray system is an ESF, which has the dual function of removing heat and fission product iodine from the post-accident containment atmosphere. The system consists of two redundant, independent trains. Each train consists of a containment spray pump, a containment isolation valve that also serves as a throttle valve, piping, instrumentation, and a containment spray ring header with 90 spray nozzles. Each containment spray pump is provided with two suction paths, one from the borated water storage tank (BWST) and the other from the containment emergency sump. One train of containment spray, operating in conjunction with one containment air cooler, is designed to remove the total post-LOCA heat release to the containment.

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

- cool and condense the post-LOCA containment atmosphere to reduce its pressure
- mix the containment atmosphere to prevent the stratification of hydrogen
- maintain containment design temperature and pressure limits following a LOCA
- reduce elemental and particulate fission product iodine in the containment atmosphere
- provide containment isolation

LRA Table 2.3.2-2 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.2.2.3 Conclusion

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

2.3.2.3 Core Flooding System

2.3.2.3.1 Summary of Technical Information in the Application

The core flooding system is designed to store borated water for pressure injection into the RPV in the event of an accident which lowers the RCS below the pressure maintained in the two core flooding tanks. The core flooding system is divided into two injection trains. Each train has a separate core flooding tank which discharges to separate reactor core flooding nozzles. Each train is self-contained and self-actuated allowing the system to perform its emergency core cooling system (ECCS) function without relying on any auxiliary system or electrical power sources.

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

- supply water to the reactor when RCS pressure falls below core flood tank pressure following a LOCA
- provide containment isolation
- maintain RCS pressure boundary integrity
- isolate core flood tanks when cooling down before going below 700 pounds per square inch gauge (psig)

LRA Table 2.3.2-3 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.2.3.3 Conclusion

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

2.3.2.4 Decay Heat Removal and Low-Pressure Injection System

2.3.2.4.1 Summary of Technical Information in the Application

The DHR and low-pressure injection system provides both normal operating and emergency operating functions. The system, operating in the DHR mode, removes decay heat from the core and sensible heat from the RCS during the later stages of cooldown. The system also provides auxiliary spray to the pressurizer for complete depressurization, maintains the reactor coolant temperature during refueling, and provides a means for filling and partial draining of the refueling canal. In the event of a LOCA, the system injects borated water into the RPV for long-term emergency cooling.

During the injection phase following a LOCA, the DHR system, operating in the low-pressure injection mode, in conjunction with the HPI system, will operate to provide full protection over the entire spectrum of break sizes. At the lower RCS pressures, the DHR system, along with the core flooding system and the HPI system, will inject borated water into the core to ensure adequate core cooling.

For small breaks, the RCS pressure may be higher than the maximum DHR pump head. Under these circumstances a crossover connection permits alignment of the HPI pumps to take suction from the outlet of the DHR coolers to provide for recirculation to the reactor core.

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

- provide controlled cooldown of the RV and core during the latter stages of plant cooldown, and maintain coolant temperature during shutdown and refueling operations
- provide post-LOCA emergency core cooling
- provide containment isolation
- provide a pressurized water supply from the containment emergency sump to the suction of the HPI pumps during piggyback mode of operation
- provide containment heat removal
- provide an alternate minimum flow path for HPI after isolating the BWST prior to establishing recirculation from the containment emergency sump during a small-break LOCA
- control reactivity and boron concentration in the RCS and prevent post-LOCA boron precipitation
- provide low-temperature over-pressure protection of the RCS
- provide means to sample the containment emergency sump fluid during the sump mode of ECCS operation
- provide RCS pressure boundary integrity

LRA Table 2.3.2-4 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.2.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.4 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.2.4.3 Conclusion

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

2.3.2.5 High-Pressure Injection System

2.3.2.5.1 Summary of Technical Information in the Application

The HPI system uses HPI pumps to pump borated water from the BWST into the RCS cold leg piping near the reactor inlet nozzles. The HPI pumps are capable of injecting BWST water into the RCS over the RCS pressure range of approximately 1600 psig to 0 psig with an injection rate of 900 gallons per minute for one HPI pump at 0 psig RCS pressure.

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

- provide emergency core cooling for small-break LOCA
- provide borated water for reactor coolant makeup and to decrease reactivity
- provide makeup for reactor coolant contraction due to excessive cooling of the RCS
- provide containment isolation
- maintain RCS pressure boundary integrity
- maintain boric acid concentration below its solubility limit during post-accident cooling

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

2.3.2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.5 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.2.5.3 Conclusion

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

2.3.3 Auxiliary Systems

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

- LRA Section 2.3.3.1, “Auxiliary Building Heating, Ventilation, and Air Conditioning (HVAC) Systems”
- LRA Section 2.3.3.2, “Auxiliary Building Chilled Water System”
- LRA Section 2.3.3.3, “Auxiliary Steam and Station Heating System”
- LRA Section 2.3.3.4, “Boron Recovery System”
- LRA Section 2.3.3.5, “Chemical Addition System”
- LRA Section 2.3.3.6, “Circulating Water System”
- LRA Section 2.3.3.7, “Component Cooling Water System”
- LRA Section 2.3.3.8, “Containment Hydrogen Control System”
- LRA Section 2.3.3.9, “Containment Purge System”
- LRA Section 2.3.3.10, “Containment Vacuum Relief System”
- LRA Section 2.3.3.11, “Demineralized Water Storage System”
- LRA Section 2.3.3.12, “Emergency Diesel Generators System”
- LRA Section 2.3.3.13, “Emergency Ventilation System”
- LRA Section 2.3.3.14, “Fire Protection System”
- LRA Section 2.3.3.15, “Fuel Oil System”
- LRA Section 2.3.3.16, “Gaseous Radwaste System”
- LRA Section 2.3.3.17, “Instrument Air System”
- LRA Section 2.3.3.18, “Makeup and Purification System”
- LRA Section 2.3.3.19, “Makeup Water Treatment System”
- LRA Section 2.3.3.20, “Miscellaneous Building HVAC System”
- LRA Section 2.3.3.21, “Miscellaneous Liquid Radwaste System”
- LRA Section 2.3.3.22, “Nitrogen Gas System”
- LRA Section 2.3.3.23, “Process and Area Radiation Monitoring System”
- LRA Section 2.3.3.24, “Reactor Coolant Vent and Drain System”
- LRA Section 2.3.3.25, “Sampling System”
- LRA Section 2.3.3.26, “Service Water System”
- LRA Section 2.3.3.27, “Spent Fuel Pool Cooling and Cleanup System”
- LRA Section 2.3.3.28, “Spent Resin Transfer System”
- LRA Section 2.3.3.29, “Station Air System”
- LRA Section 2.3.3.30, “Station Blackout Diesel Generator System”
- LRA Section 2.3.3.31, “Station Plumbing, Drains, and Sumps System”
- LRA Section 2.3.3.32, “Turbine Plant Cooling Water System”

Auxiliary Systems Generic Requests for Additional Information. In RAI 2.3-01, dated March 18, 2011, the staff noted 24 instances on drawings where the staff was unable to identify the license renewal boundary because continuations were not provided or were incorrect. The applicant was asked to provide additional information to locate the continuations.

In its response dated April 15, 2011, the applicant provided information to clarify the extent of the license renewal boundary for each of the 24 continuations. In each case, the applicant detailed the routing and location of the piping in question.

Based on its review, the staff finds the applicant's response to RAI 2.3-01 acceptable because the applicant provided additional information to locate the license renewal boundaries, and, in all cases, the extent of the license renewal boundary was determined in accordance with the requirements of the scoping and screening methodology. No new systems or components were added to the scope of license renewal as a result of the response to RAI 2.3-01, and no component types were identified that had not been previously evaluated. Therefore, the staff's concern described in RAI 2.3-01 is resolved.

2.3.3.1 Auxiliary Building Heating, Ventilation, and Air Conditioning Systems

2.3.3.1.1 Summary of Technical Information in the Application

The auxiliary building heating, ventilation, and air conditioning (HVAC) systems consist of the control room HVAC, fuel-handling area heating and ventilation (fuel-handling area ventilation), nonradioactive areas heating and ventilation (nonradwaste area ventilation), and radioactive areas heating and ventilation (radwaste area ventilation).

The HVAC systems for the control room are designed to provide a suitable environment for equipment and station operator comfort and safety. The HVAC systems for the nonradioactive areas are designed to provide a suitable environment for equipment and personnel. The HVAC system for the fuel-handling and radioactive areas is independent of that used in any other areas and is designed on a once-through basis to control and direct all potentially contaminated air to the station vent stack via roughing and high-efficiency particulate air filters.

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

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.1.3 Conclusion

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

2.3.3.2 Auxiliary Building Chilled Water System

2.3.3.2.1 Summary of Technical Information in the Application

The auxiliary building chilled water system consists of two chilled water pumps (in parallel) discharging to a common header. The system is designed to ensure chilled water is continuously supplied to the computer room air conditioning unit DB-S77, control room air handling unit cooling coils DB-E44 and DB-E45, access control area duct cooling coil DB-E47, and the electric penetration room cooling coil DB-E78. After providing cooling to the coils, the heated water is returned to the pump suction via an air separator and chilled water system expansion tank DB-T88, which is provided to alleviate any surges and thermal expansion in the closed loop chilled water system. The expansion tank also provides suction pressure for the chilled water pumps.

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

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.2.3 Conclusion

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

2.3.3.3 Auxiliary Steam and Station Heating System

2.3.3.3.1 Summary of Technical Information in the Application

The auxiliary steam system is supplied with steam from the main steam system. Superheated steam is drawn from the main steam header downstream of the main steam isolation valves and is passed through a pressure reducing valve, which reduces the steam pressure prior to introducing the steam to the auxiliary steam system header. The header supplies steam to components either directly or via other steam headers at reduced pressures. The station heating system uses a closed loop, circulating hot water system in which hot water is circulated through a primary loop that feeds various secondary loops. The primary loop provides a constant supply of hot water for conveying heat to the secondary loops while the secondary loops serve the terminal heat transfer units.

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

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.3.3 Conclusion

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

2.3.3.4 Boron Recovery System

2.3.3.4.1 Summary of Technical Information in the Application

The boron recovery system is designed to do the following:

- collect, store, process, and reuse or dispose of radioactive reactor grade liquid from various sources
- remove boron from the reactor coolant letdown to maintain proper boron coolant chemistry
- collect, store, process, and reuse or dispose of recovered boron

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

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4, USAR Section 11.2.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

In RAI 2.3.3.4-01 dated March 18, 2011, the staff stated that, on license renewal drawing LR-M033B, Revision 0, Location G-8, a Section of 10 CFR 54.4 (a)(2) piping (1"-HSC-18) was noted continuing from drawing LR-M037D, location C-5 (from the Sodium Hydroxide Mix Tank) where it is not included within the scope of license renewal. The applicant was asked to provide additional information to clarify the scoping classification of this pipe section.

In its response dated April 15, 2011, the applicant stated that the line from drawing LR-M037D is within the scope of license renewal and subject to an AMR. Drawing LR-M037D was revised to include line 1"-HSC-18 to the isolation boundary.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-01 acceptable because the applicant extended the license renewal boundary to meet the requirements of their scoping and screening methodology. No changes to the list of component types requiring AMR were required. Therefore, the staff's concern described in RAI 2.3.3.4-01 is resolved.

2.3.3.4.3 Conclusion

The staff reviewed the LRA, USAR, RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the boron recovery system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.5 Chemical Addition System

2.3.3.5.1 Summary of Technical Information in the Application

The chemical addition system consists of the boric acid addition (BAA) system, reactor coolant chemical addition system, and SG wet layup chemical addition system. The BAA system injects boric acid into the RCS to control reactivity and the BWST system and spent fuel pool cooling systems to control their boron levels. The chemical addition system provides a boric acid solution to the BAA system and provides lithium hydroxide, hydrazine, ammonia, and other chemical amines to control pH and oxygen in the plant systems fed by the reactor coolant chemical addition system and SG wet layup chemical addition system.

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

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.5.3 Conclusion

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

2.3.3.6 Circulating Water System

2.3.3.6.1 Summary of Technical Information in the Application

The circulating water system removes heat from the condenser and then disperses this heat to the atmosphere via the cooling tower. The circulating water system also provides a backup supply of water for cooling the turbine plant cooling water (TPCW) heat exchangers, provides dilution flow to the collection box during planned discharge of processed radioactive liquid, and receives the discharge of the service water system and the drainage from the condenser hotwell during hotwell cleanup operations.

LRA Table 2.3.3-6 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.6.3 Conclusion

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

2.3.3.7 Component Cooling Water System

2.3.3.7.1 Summary of Technical Information in the Application

The component cooling water (CCW) system is a closed loop system that provides cooling water to the nuclear and ESF systems. It also acts as an intermediate barrier between radioactive systems and the service water system. The system consists of three circulating pumps, three heat exchangers, a surge tank, associated valves, piping, instrumentation, and controls.

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

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.7.3 Conclusion

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

2.3.3.8 Containment Hydrogen Control System

2.3.3.8.1 Summary of Technical Information in the Application

The containment hydrogen control system includes the containment hydrogen dilution system and containment gas analyzer system. The containment hydrogen dilution system was designed to add air to the containment vessel to effectively maintain hydrogen concentrations within acceptable limits. The containment hydrogen dilution system consists of redundant trains of a 100 percent-capacity air compressor (blower). The containment gas analyzer system monitors the containment atmosphere for hydrogen after a LOCA. The containment gas analyzer system consists of two redundant operating trains. Each train consists of a heat exchanger, recombiner, moisture removal system, and gas sampling system.

When the hydrogen in the containment reaches 3 percent by volume, the containment hydrogen dilution system is manually initiated to introduce air into the containment to dilute the hydrogen concentration if the pressure inside containment is less than 32.4 pounds per square inch absolute (psia). The containment hydrogen dilution system is used to pressurize the containment vessel to 32 psia, and then the containment purge system is lined up to the station exhaust.

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

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.8.3 Conclusion

The staff reviewed the LRA, USAR, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the containment hydrogen control system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the containment hydrogen control system components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.9 Containment Purge System

2.3.3.9.1 Summary of Technical Information in the Application

The containment purge system is designed to purge containment during normal plant operation. The system is normally in operation ventilating the mechanical penetration rooms in order to maintain temperature and control noble gas levels. The containment purge system serves as a backup to the containment hydrogen dilution system and is designed to release containment air through a high-efficiency particulate air and a charcoal filter prior to discharge to the station exhaust.

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

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.9.3 Conclusion

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

2.3.3.10 Containment Vacuum Relief System

2.3.3.10.1 Summary of Technical Information in the Application

The containment vacuum relief system is designed to maintain the integrity of the containment vessel by permitting an influx of air to the containment under positive external differential pressure conditions. The containment vacuum relief system consists of 10 containment vessel piping penetrations. Each piping penetration is provided with a motor operated butterfly valve in series with a non-return (swing check) valve. The non-return valves are free to open whenever the containment negative pressure exceeds the valve unseating pressure.

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

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.10.3 Conclusion

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

2.3.3.11 Demineralized Water Storage System

2.3.3.11.1 Summary of Technical Information in the Application

The demineralized water storage system is designed to supply demineralized plant water to equipment and systems throughout the plant. The demineralized water storage system consists of two tanks, a heat exchanger, and four pumps (three transfer pumps and one recirculation pump). LRA Table 2.3.3-11 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11, USAR Section 9.2.3.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

The staff noted that on license renewal drawing LR-M010C, Revision 0, Location K-11, a fluid level gage component provided a pressure boundary function. The staff also noted that this component type was not included in LRA Table 2.3.3-11, "Demineralized Water Storage System Components Subject to Aging Management Review." By letter dated March 18, 2011, the staff issued RAI 2.3.3.11-01 requesting the applicant to justify the exclusion of the fluid level gage component type from LRA Table 2.3.3-11.

In its response dated April 15, 2011, the applicant stated that the water level indicator (instrument) is exempt from Table 2.3.3-11 because 10 CFR 54.21(a)(1)(i) specifically excludes water level indicators from AMR. The staff disagreed with the applicant's assessment, as 10 CFR 54.21(a)(1)(i) excludes only those components that perform their function via a change in configuration or properties, and the level gage component type has no moving parts and its function does not result in a change in properties. Therefore, a teleconference was held with the applicant on June 15, 2011, to clarify the response. Based on discussions during the teleconference call with the staff, the applicant provided a revised response to RAI 2.3.3.11-01. By letter dated June 24, 2011, the applicant revised the LRA to include the level gage in LRA Table 2.3.3-11 and document the AMR for this component type.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-01 acceptable because the level gage is now in-scope for license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.11-01 is resolved.

2.3.3.11.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the demineralized water storage system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified all the mechanical components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.12 Emergency Diesel Generators System

2.3.3.12.1 Summary of Technical Information in the Application

The EDG system consists of two EDGs, which are provided as onsite standby power sources to supply their respective essential buses upon loss of the normal and the reserve power sources.

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

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12, USAR Sections 8.3.1.1.4 and 9.5.4.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

In RAI 2.3.3.12-01 dated March 18, 2011, the staff noted on license renewal drawings LR-OS041A1, Location G-3, and LR-OS041A2, Location G-21, sight glass components as within the scope of license renewal. The staff also stated that at Locations G-7 and G-25 on the same drawings, flow glass components are shown as within the scope of license renewal. The staff further noted that the sight glass and flow glass components perform a pressure boundary function, but they were not included in LRA Table 2.3.3-12, "Emergency Diesel Generator System Components Subject to Aging Management Review." The staff requested the applicant to justify the exclusion of the sight glass and flow glass component types from LRA Table 2.3.3-12.

In its response dated April 15, 2011, the applicant stated that the water level indicator (instrument) is exempt from Table 2.3.3-12 because 10 CFR 54.21(a)(1)(i) specifically excludes water level indicators from AMR. The staff disagreed with the applicants assessment, as 10 CFR 54.21(a)(1)(i) excludes only those components that perform their function via a change in configuration or properties, and the sight glass and flow glass component types have no moving parts and their function does not result in a change in properties. Therefore, a teleconference was held with the applicant on June 15, 2011, to clarify the response. Based on discussions during the teleconference call with the staff, the applicant provided a revised response to RAI 2.3.3.11-03. By letter dated June 24, 2011, the applicant revised the LRA to include the level gage and flow gage in LRA Table 2.3.3-12 and document the AMR for this component type.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-01 acceptable because the level gage and flow gage components are now in-scope for license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.12-01 is resolved.

2.3.3.12.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the EDGs system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified all the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.13 Emergency Ventilation System

2.3.3.13.1 Summary of Technical Information in the Application

The function of the emergency ventilation system is to collect and process potential leakage from the containment vessel to minimize environmental activity levels resulting from all sources of containment leakage following a LOCA. The emergency ventilation system is designed to provide a negative pressure with respect to the atmosphere within the annular space between the shield building and the containment vessel and in the penetration rooms following a LOCA and to provide a filtered exhaust path from the shield building annulus, penetration rooms, and pump rooms following a LOCA. The emergency ventilation system also provides a filtered ventilation path with an assigned filter efficiency of 95 percent for the areas served by the containment purge system or the auxiliary building radioactive area HVAC systems in the event that high radiation is detected in any of these ventilation systems. The system consists of exhaust fans, prefilters, high-efficiency particulate air filters to remove airborne particulates, and charcoal absorbers to remove gaseous activity (principally iodine).

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

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.13 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.13.3 Conclusion

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

2.3.3.14 Fire Protection System

2.3.3.14.1 Summary of Technical Information in the Application

The fire protection system consists of the fire protection water supply system, wet pipe sprinkler systems, preaction sprinkler systems, deluge sprinkler systems, and water spray systems. The fire suppression system provides water for all in-scope automatic and manual fire suppression systems. The system consists of a fire water storage tank, an electric motor-driven fire pump, a diesel engine-driven fire pump, standpipes, and fire hydrants. Two separate water supplies and fire pumps are used to deliver water to the system. The primary supply consists of a fire water storage tank from which an electric motor-driven fire pump receives water. The secondary water supply is Lake Erie, from which a diesel engine-driven fire pump takes suction.

The fire protection system does not perform any safety-related system intended functions that satisfy the scoping criteria of 10 CFR 54.4(a)(1). The fire protection system does not contain any nonsafety-related components that are identified in the CLB as having the potential to prevent the satisfactory accomplishment of a function identified in 10 CFR 54.4(a)(1). However, the fire protection system does contain nonsafety-related components that are attached to or located near safety-related SSCs, whose failure creates a potential for spatial interaction that could prevent the satisfactory accomplishment of a function identified in 10 FR 54.4(a)(1). Therefore, the fire protection system satisfies the scoping criteria of 10 CFR 54.4(a)(2). The fire protection system is relied upon to demonstrate compliance with, and satisfy the 10 CFR 54.4(a)(3) scoping criteria for, the fire protection (10 CFR 50.48) regulated event.

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

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, the USAR, and LRA drawings using the evaluation methodology described in the SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff also reviewed the fire hazards analysis report reference in USAR Section 9.5.1 “Fire Protection Evaluation and Comparison,” to BTP APCSB 9.5-1, Appendix A Report (i.e., approved Fire Protection Program), a point-by-point comparison with Appendix A to the BTP, APCSB, Section 9.5-1, “Guidelines for Fire Protection for Nuclear Power Plants,” May 1, 1976. The staff also reviewed SERs, dated July 26, 1979 and May 30, 1991 which are fire protection documents cited in the CLB, listed in Davis-Besse’s Operating License Condition 2.C(4).

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

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

In RAI 2.3.3.14-1 dated February 17, 2011, the staff noted that LRA drawing LR-M016A shows that several yard fire hydrants and post-indicator valves are not within the scope of license renewal (i.e., not colored in green). The staff stated that yard fire hydrants and post-indicator valves have the fire protection intended functions required to be in compliance with 10 CFR 50.48, as stated in 10 CFR 54.4. The fire hydrants and post-indicator valves also serve as the pressure boundary for the fire protection water supply system.

The staff requested the applicant to verify whether the yard hydrants and post-indicator valves are in the scope of license renewal, in accordance with 10 CFR 54.4(a), and whether they are subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and are not subject to an AMR, the staff requested the applicant to justify their exclusion.

In a letter dated March 18, 2011, the applicant responded to RAI 2.3.3.14-1 addressing the subject yard hydrants and post-indicator valves. Based on its review, the staff finds the applicant’s response acceptable because it clarifies that the fire hydrants listed in Section 8.2.4 and Table 8-6 of the fire hazards analysis report are required for regulatory compliance and are in-scope and highlighted as such on the drawing. Those fire hydrants not in Section 8.2.4 and Table 8-6 of the fire hazards analysis report and not required for regulatory compliance are provided with valves to ensure the license renewal pressure boundary is maintained. They are not in-scope and, thus, not highlighted on the drawing. The staff found that the fire hydrants included within the scope of license renewal encompass the fire hydrants included in Table 8-6 of the fire hazards analysis report and reference USAR Section 9.5.1, “Fire Protection Program.” They were reviewed and approved by the staff in a safety evaluation dated July 26, 1979, as part of the original licensing basis of Davis-Besse; therefore, the staff’s concern described in the RAI 2.3.3.14-1 is resolved.

In RAI 2.3.3.14-2 dated February 17, 2011, the staff stated that LRA drawing LR-M016B shows that the automatic sprinkler system for the No. 1 diesel generator (DG) room is within the scope of license renewal and subject to an AMR. However, the automatic sprinkler system for the No. 2 DG room does not appear in the LRA drawings as being in the scope of license renewal and subject to an AMR. The staff requested that the applicant verify whether the automatic sprinkler system for the No. 2 DG room is in the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If the sprinkler system is excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant justify the exclusion.

In its response dated March 18, 2011, the applicant stated that the automatic sprinkler system for the No. 2 DG room is within the scope of license renewal and is subject to an AMR.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.14-2 acceptable because the fire protection system and components in question were identified to be within the scope of license renewal and subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.14-2 is resolved.

In RAI 2.3.3.14-3 dated February 17, 2011, the staff stated that Tables 2.3.3-14 and 3.3.2-14 of the LRA do not include the following fire protection components:

- fire hose stations, fire hose connections, and hose racks
- sprinkler heads
- floor drains for fire water
- dikes and curbs for oil spill confinement
- components in RCP oil collection system

The staff requested that the applicant verify whether the fire protection components listed above are in the scope of license renewal, in accordance with 10 CFR 54.4(a), and whether they are subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and are not subject to an AMR, the staff requested that the applicant justify the exclusion.

In a letter dated March 18, 2011, the applicant stated that fire hose stations, fire hose connections, and hose racks are in the scope of license renewal and subject to an AMR. The applicant stated that fire hose stations, fire hose connections, and hose racks are included under line item “piping and piping components and valve bodies,” which are in the scope of license renewal and subject to an AMR and listed in LRA Tables 2.3.3-14 and 3.3.2-14. Further, LRA Tables 2.4-13 and 3.5.2-13 include cabinets and racks associated with hose stations. In its response, the applicant confirmed that sprinkler heads are included under line item “Spray Nozzle,” which are in the scope of license renewal and subject to an AMR and listed in Tables 2.3.3-14 and 3.3.2-14 and are subject to an AMR. The applicant considered floor drains for fire water under component type “Piping,” listed in LRA Tables 2.3.3-31 and 3.3.2-31.

The dikes and curbs for oil spill confinement are included under “Yard Structures,” as component type “Diesel Oil Storage tank Retaining Area and Dike,” in LRA Tables 2.4-12 and 3.5.2-12 and with “Bulk Commodities” as concrete component type “Flood Curbs,” in LRA Tables 2.4-13 ad 3.5.2-13. In its response, the applicant confirmed that components in the RCP oil collection system are included under line item component type “Drain Pan,” which are in the scope of license renewal, subject to an AMR, and listed in Tables 2.3.1-3 and 3.1.2-3. In addition, the applicant indicated that the LRA Tables 2.4-13 and 3.5.2-13 are revised to include support for criterion 10 CFR 54.4(a)(3) equipment as an intended function for concrete component type flood curbs.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.14-3 acceptable because the fire protection components in question were identified to be within the scope of license renewal and subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.14-3 is resolved.

LRA Tables 2.3.3-14 and 3.3.2-14, item “Heat Exchanger (tubes)—Fire water storage tank heat exchanger (DB-E52),” originally proposed a one-time inspection to manage the reduction in heat transfer of stainless steel tubes. The Generic Aging Lessons Learned (GALL) Report states that stainless steel components exposed to steam are susceptible to loss of material and stress corrosion cracking (SCC). However, the applicant did not identify these aging effects for this component.

By letter dated July 27, 2011, the staff issued RAI 3.3.2.14-1, requesting that the applicant justify why loss of material and SCC are not applicable aging effects for the fire water storage tank heat exchanger tubes exposed to steam.

In its response dated August 26, 2011, the applicant stated that the only license renewal function for the heat exchanger is reduction of heat transfer, and the only aging mechanism that is identified as causing the aging effect of reduction of heat transfer is the aging mechanism of fouling. The applicant also stated that loss of material and cracking would ultimately affect the pressure boundary function of the tubes. The applicant further stated the following:

> The fire water storage tank heat exchanger tubes are not credited with a license renewal pressure boundary function. Should the heat exchanger tubes leak, fire water would not leak from the tubes; rather, the higher pressure (i.e., approximately 50 psig) steam from the auxiliary steam system on the external surfaces of the tubes would pass through the tubes and mix with fire water (approximately 25 psig), thereby continuing to add heat to the water. Fire water storage tank level would increase due to water entering the system, but level in the tank could be controlled (i.e., feed-and-bleed) to prevent the tank from overflowing onto the ground. A breach of the heat exchanger tubes would result in continued heat transfer to fire water, and would not prevent the fire water system from performing its functions. Therefore, loss of material and stress corrosion cracking are not applicable license renewal aging effects for the fire water storage tank heat exchanger tubes exposed to steam.

A teleconference was held on September 13, 2011, to further discuss this issue and determine, with a heat exchanger tube failure, whether the fire water storage tank’s design could contain a water/steam environment. The applicant stated that the heat exchanger was not subject to license renewal scope based on the fire hazard analysis report. The applicant was asked to fully document their argument for the component’s removal.

In a supplemental response dated October 7, 2011, the applicant revised the LRA to delete the fire water storage tank heat exchanger (DB-E52) and fire water storage tank recirculation pump casing (DB-P114). In addition, license renewal boundary drawing LR-M016A, "Station Fire Protection System," was revised to remove highlighting of the piping and components associated with the fire water storage tank heat exchanger (DB-E52) and fire water storage tank recirculation pump 1-1. The applicant stated that the fire water storage tank heat exchanger and recirculation pump are not within the scope of license renewal since the subject components do not satisfy the scoping criteria of 10 CFR 54.4(a)(1), (a)(2), or (a)(3). The applicant also stated that the heat exchanger and the recirculation pump are used to establish initial conditions associated with event assumptions and perform no fire protection functions. The applicant further stated that it is the monitoring of the fire water storage tank that is credited with ensuring the appropriate initial conditions; therefore, the heat exchanger and recirculation pump are not in-scope of license renewal for the fire protection regulated event.

It is the staff's position that these components are required to maintain temperature in the fire water tank above 35 °F. The Davis-Besse fire hazard analysis report Section 8.1.2, "Fire Suppression Water System," states that "… the temperature of the contained water supply is greater than 35 °Fahrenheit (F) every 24 hours during October through March," which is confirmed using surveillance. Therefore, the staff finds that these components should not be excluded from the fire water system on the basis that they are not required to function to suppress a fire; rather, they should be included to support the need to maintain the tank water temperature to greater than 35 °F.

A second teleconference was held on November 1, 2011, to discuss the staff's position that the deletion of these components was not consistent with the CLB.

It is not clear to the staff how the removal of these fire protection system components is consistent with the fire hazard analysis report associated with the original Davis-Besse fire protection SERs and the plant's CLB. The staff does not agree with the applicant's proposal that these components are not included within scope per 10 CFR 54.4(a)(3). Further, these fire protection components are required for compliance with 10 CFR 50.48 and should be subject to an AMR as required by 10 CFR 54.21. The revised LRA does not demonstrate that the aging effects associated with the fire protection system are adequately managed so that there is reasonable assurance that the system components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

If these components are excluded from the scope of license renewal and not subject to an AMR then the applicant has to justify how the fire water storage tank will maintain water temperature above 35 °F without the heat exchanger. If other systems and components are used to maintain fire water tank's temperature above 35 °F, then the applicant should provide an appropriate AMP to manage aging for the systems and components inclusive of all applicable aging effects.

By letter dated November 8, 2011, the staff issued RAI 3.3.2.14-2 requesting that the applicant justify how the fire water storage tank will be maintained greater than 35 °F at all times without the heat exchanger or provide an appropriate AMP to manage aging for the original component and their subcomponents inclusive of all applicable aging effects. The staff further requested that the applicant provide the procedure steps that would be used to maintain the fire water storage tank temperature if components are excluded and other methods are used for the tank's primary temperature function.

In its response dated November 23, 2011, the applicant stated that the fire water storage tank heat exchanger and associated components are in the scope of license renewal and that these items are appropriately managed for all applicable aging effects. The applicant also revised LRA Table 3.3.2-14 to state that stainless steel heat exchanger tubes exposed to steam (external) are being managed for reduction in heat transfer, cracking, and loss of material. The staff finds the applicant's response and proposal to manage these aging effects with the Pressurized-Water Reactor (PWR) Water Chemistry and the One-Time Inspection Programs acceptable because these programs will establish plant water chemistry control parameters to mitigate aging. Additionally, the One-Time Inspection Program will include visual inspection techniques capable of detecting reduction of heat transfer, cracking, and loss of material to verify the effectiveness of the water chemistry controls. The staff concerns described in RAIs 3.3.2.14-1 and 3.3.2.14-2 are resolved.

2.3.3.14.3 Conclusion

The staff reviewed the LRA, USAR, and RAI responses, and drawings to determine whether the applicant identified all fire protection systems and components within the scope of license renewal. In addition, the staff sought to determine whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes, that the applicant adequately identified the fire protection system components that are within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the fire protection system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.15 Fuel Oil System

2.3.3.15.1 Summary of Technical Information in the Application

The fuel oil system consists of the following main components: diesel oil transfer pump, diesel oil storage tank, and fire pump diesel day tank. The fire pump diesel day tank supplies diesel fuel oil to the fire pump diesel engine. The fire pump diesel day tank is refilled through a fill line from the diesel oil storage tank. The fire pump diesel day tank will contain sufficient fuel to operate the diesel engine at full load for a minimum of 8 hours. The diesel oil storage tank can supply fuel oil, via a diesel oil transfer pump and a temporary connection through a valve, to the EDG day tanks in the event of a serious fire event coincident with the failure of the EDG fuel oil transfer pump.

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

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.15.3 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3, and on a review of the LRA, USAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the fuel oil system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant 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 Gaseous Radwaste System

2.3.3.16.1 Summary of Technical Information in the Application

The function of the gaseous radwaste system is to collect, hold, and reuse or dispose of radioactive gas generated by the station. The system is designed so that estimated releases of gaseous effluents from the station comply with the requirements of 10 CFR Part 20 and 10 CFR Part 50.

Hydrogen and fission product gases are vented from the reactor coolant drain tank, makeup tank, and containment vent header and returned from the sample system to the waste gas surge tank. From the waste gas surge tank, the radioactive gaseous waste is sent to one of two waste gas compressors and then transferred to one of three waste gas decay tanks. Once a decay tank is full, the waste gas decays in the tank for at least 30 days, after which the waste gas exits the decay tank and either is released in a controlled manner or reused as a cover gas for the clean waste receiver tanks or clean waste monitor tanks. The gas that is released from the waste gas decay tank passes through an absolute filter, charcoal filter, and two radiation detectors prior to being released. The second waste gas compressor takes its suction from a header containing displaced cover gas from the clean liquid radwaste system and vent gases from the boric acid evaporators. This gas is kept separate from the waste gas surge tank gas and is processed in much the same manner as described above.

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

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.16.3 Conclusion

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

2.3.3.17 Instrument Air System

2.3.3.17.1 Summary of Technical Information in the Application

The instrument air system is designed to provide a reliable continuous supply of dry, oil-free compressed air for pneumatic instrument operation and for control of pneumatic valves. The instrument air system consists of a 100 percent capacity emergency instrument air compressor provided to supply instrument air during a malfunction of the station air compressors with prefilters, two sets of heatless air dryers, and after-filters. The station air system supplies air to the instrument air system upstream of the dryer prefilters.

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

2.3.3.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.17 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.17.3 Conclusion

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

2.3.3.18 Makeup and Purification System

2.3.3.18.1 Summary of Technical Information in the Application

The makeup and purification system is designed to control the RCS inventory during all phases of normal reactor operation. The system operates in conjunction with the pressurizer to accommodate changes in the reactor coolant volume due to small temperature changes. The system also serves to receive, purify, and recirculate reactor coolant water during reactor operation. Proper chemistry in the RCS is maintained by the makeup and purification system. The system serves to maintain the required boron concentration in order to control reactivity, and it adds borated water to the core flooding tanks. The system also serves to maintain the proper concentration of hydrogen and hydrazine for oxygen control, lithium for pH control, and to degas the RCS. In addition, the makeup and purification system also serves to supply high-pressure water from the makeup tank to the seals of the RCPs. The system also provides makeup to the RCS for protection against small breaks in the RCS pressure boundary. In the event of a loss of all secondary side cooling, the makeup and purification system operates to provide feed and bleed capability to maintain core cooling.

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

2.3.3.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.18, USAR Section 9.3.4, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

In RAI 2.3.3.18-01 dated March 18, 2011, the staff noted that license renewal drawing LR-M031C, Revision 0, Location D-13, shows a 10 CFR 54.4(a)(2) line 1½"-HSC-61, continued on drawing LR-M040A, Location E-8, as not within the scope of license renewal. The staff asked the applicant to clarify the scoping classification of this pipe section.

In its response dated April 15, 2011, the applicant stated that the 1½"-HSC-61 line continuing to drawing LR-M040A, Location E-8, is within the scope of license renewal. A revised drawing with included highlighting was also provided.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-01 acceptable because the applicant extended the license renewal boundary to meet the requirements of their scoping and screening methodology. No changes to the list of component types requiring AMR were required. Therefore, the staff's concern described in RAI 2.3.3.18-01 is resolved.

LRA Section 2.3.3.18, states in part that the letdown coolers, designated as DB-E25-1 and DB-E25-2, are periodically replaced and evaluated as short-lived components (consumables); therefore, they are not subject to an AMR. However, the LRA did not include information regarding the replacement frequency or any discussion regarding the reasons these normally long-lived components need to be replaced. By letter dated May 2, 2011, the staff issued RAI 2.3.3.18-2, asking the applicant to provide the basis for the replacement frequency of the letdown coolers and information to demonstrate that the cooler's intended function is being maintained consistent with its CLB immediately prior to replacement. Additionally, the staff requested the circumstances surrounding the need to replace these coolers including details of the extent of condition and cause evaluation that was conducted.

In its response dated June 3, 2011, the applicant stated that the replacement frequency of the letdown coolers is based on a qualified life, using plant-specific operating experience that indicates that the letdown coolers have a tendency to develop leaks after seven to eight cycles and the replacement is scheduled every seventh refueling outage (RFO) (approximately 14 years). The applicant also stated that the need to replace the letdown coolers was attributed to fatigue cracking due to flow-induced vibrations, which led to reactor coolant leakage into the CCW system. The applicant further stated that corrective actions from the most recent occurrence generated a preventive maintenance task to replace the coolers since suitable examination techniques could not be identified for the letdown coolers.

Because the applicant's response lacked specificity regarding the ability of the coolers to meet their intended function immediately prior to replacement, by letter dated July 21, 2011, the staff issued RAI 2.3.3.18-3 requesting that the applicant to do the following:

- provide a summary of plant-specific operating experience associated with letdown coolers
- provide a summary of any past evaluations of the cause for previous leakage
- provide information related to determining that the cooler's intended CLB function was met just prior to replacement

In its response dated August 17, 2011, the applicant stated the following:

- In 1991, the plant experienced high contamination levels in the CCW system due to a tube leak in one of the letdown coolers. The letdown coolers were replaced in 1993. In 2009, the chemistry samples indicated that there was a small active leak into the CCW system that was once again determined to be as a result of a tube leak in one of the letdown coolers. Both letdown coolers were replaced in 2010, and a fixed interval replacement preventive maintenance task was created.

- Based on the high dose associated with the coolers and the known industry operating experience of leaks in letdown coolers, no failure analysis was conducted.
- The letdown coolers were determined to be meeting their CLB function because component cooling activity levels remained low, RCS unidentified leakage was essentially unchanged, there was an absence of radiation monitoring alarms, and there were no unexplained increases in the CCW surge tank level.

The staff reviewed the applicant's response and found that the applicant had not provided sufficient bases to justify the replacement frequency of every seventh RFO for the following reasons:

- The limited site experience (two occurrences) introduces a large uncertainty in the amount of time before the onset of leakage.
- The lack of flaw identification or sizing introduces additional unknowns into the amount of time before flaw initiation and flaw growth prior to a tube rupture.
- Given that the applicant proposed to not age manage these components, discovery of the heat exchanger tube pressure boundary failure will be event-driven versus monitoring for gradual degradation, which could allow corrective actions prior to potentially challenging the CLB function of the component.

By letter dated September 22, 2011, the staff issued RAI 2.3.3.18-4, asking the applicant to provide a letdown cooler frequency that includes adequate margin to initiation of tube leakage and to provide the basis for the margin or to propose an AMP that will manage the coolers.

In its response dated October 21, 2011, the applicant revised its responses to RAIs 3.3.2.2.4-1, 2.3.3.18-2, and 2.3.3.18-3. It stated that cracking due to SCC in letdown coolers and seal return coolers in the makeup and purification system is being managed by the PWR Water Chemistry and One-Time Inspection Programs. The response also stated that the temperature and radioactivity monitoring of the shell side water is performed by installed instrumentation, and the coolers are not subject to cyclic loading since they are in continuous service. The response also revised LRA Section 2.3.3.18, Table 2.3.3-18, Section 3.3.2.1.18, Section 3.3.2.2.4.1, Table 3.3.1, Table 3.3.2-18, and Table A-1 to be consistent with the change discussed above. The consequent changes to these portions of the LRA in the response to RAI 3.3.2.2.4-1 are discussed in SER Section 3.3.2.2.4.1.

In its review of the applicant's response, the staff noted that the applicant's statement regarding the letdown coolers not being subject to cyclic loading appeared to be inconsistent with the response provided on August 17, 2011, to RAI 2.3.3.18-3. Specifically, the applicant had previously stated that the recurring tube leaks in the letdown cooler were caused by flow-induced vibration, which indicated to the staff that the tubes were subject to cyclic loading. The staff discussed its concern with the applicant during a conference call on November 9, 2011, and the applicant agreed to provide a supplemental response to address the staff's concern.

In its supplemental response to RAI 2.3.3.18-4, dated November 23, 2011, the applicant revised its previous response by deleting the statement that the letdown coolers are not subject to cyclic loading. The applicant also revised its Closed Cooling Water Chemistry Program to include an enhancement to ensure that CCW is sampled on a weekly interval to verify the integrity of the letdown coolers and seal return coolers. The response also revised LRA Section 3.3.2.2.4.1, Table 3.3.1, Section A.1.8, Table A-1, and Section B.2.8. The consequent changes to these portions of the LRA are discussed in SER Sections 3.0.3.2.4 and 3.3.2.2.4.1. The applicant's response is acceptable because the letdown coolers and the seal return coolers are now being managed through a combination of the PWR Water Chemistry, One-Time Inspection, and Closed Cooling Water Chemistry Programs, which include the following activities:

- controlling water chemistry on both sides of the cooler tubes in order to minimize the potential for SCC
- performing one-time inspections that are consistent with the GALL Report recommendation for stainless steel items exposed to treated borated water
- monitoring the CCW side of the cooler tubes, which has been demonstrated to detect leakage at extremely low levels and alert the applicant of the need to replace the coolers prior to their CLB function being challenged

The staff's evaluations of these programs are documented in SER Sections 3.0.3.1.15, 3.0.3.2.11, and 3.0.3.2.4, respectively. The staff's concerns described in RAIs 2.3.3.1-1, 2.3.3.18-2, 2.3.3.18-3, and 2.3.3.18-4 are resolved.

2.3.3.18.3 Conclusion

The staff reviewed the LRA, USAR, and RAI responses, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant 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 adequately identified the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.19 Makeup Water Treatment System

2.3.3.19.1 Summary of Technical Information in the Application

The makeup water treatment system uses two water treatment feed pumps located in the intake structure to supply lake water to a vendor supplied demineralized water system. Normally, one pump is in operation with the other pump on standby. The water is filtered by basket strainers, chlorinated in chlorine detention tanks, and sent to the vendor system. Water is provided from the Carroll Township water system. The fire water storage tank is supplied from the discharge of the clearwell transfer pumps.

LRA Table 2.3.3-19 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.19, USAR Section 9.2.3, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

In RAI 2.3.3.19-01 dated March 18, 2011, the staff noted on license renewal drawing LR-M011, Revision 0, Location C-7, a 6"-JEE line within the scope of license renewal for 10 CFR 54.4(a)(2). The staff stated that the license renewal boundary is shown to end at valve DM65 without an explanation for the scoping change. The staff also stated that If the piping and components upstream of valve DM65 are located within a space containing 10 CFR 54.4(a)(1) components, then the scoping boundary would need to be extended. The staff requested the applicant to justify its exclusion of the piping and components upstream of valve DM65 from the scope of license renewal.

In its response dated April 15, 2011, the applicant stated that the piping and components upstream of valve DM65 are located outside, in the station yard. Also, the applicant provided a revised drawing with a license renewal note to document the basis for exclusion of the piping in question.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.19-01 acceptable because the piping and components upstream of valve DM65 are located outside and are not required to be within scope. In addition, a revised drawing with a corresponding license renewal note was provided. Therefore, the staff's concern described in RAI 2.3.3.19-01 is resolved.

2.3.3.19.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the makeup water treatment system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.20 Miscellaneous Building Heating, Ventilation, and Air Conditioning System

2.3.3.20.1 Summary of Technical Information in the Application

The miscellaneous building HVAC system consists of the intake structure heating and ventilation system and SBODG room HVAC.

The intake structure heating and ventilation system is designed to maintain the service water pump room between 40 °F and 104 °F and the diesel fire pump room between 40 °F and 120 °F year round for all modes of operation including post-accident at design outside conditions. The system consists of four safety-related ventilation fans with associated temperature switches and controls. Each fan is sized at 50 percent of capacity needed to maintain the above room temperatures. Each channel of fans is started automatically by temperature switches at a predetermined temperature setpoint. The missile protected supply air penthouse is sized to ensure adequate supply air with all four supply fans operating simultaneously.

The SBODG room HVAC has five wall fire dampers and two room exhaust fans in the SBODG room, which are required to operate to demonstrate the functionality of the SBODG.

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

2.3.3.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.20.3 Conclusion

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

2.3.3.21 Miscellaneous Liquid Radwaste System

2.3.3.21.1 Summary of Technical Information in the Application

The miscellaneous liquid radwaste system consists of a miscellaneous waste drain tank, waste evaporator, demineralizer skid, miscellaneous waste monitor tank filters, and detergent waste drain tank.

The miscellaneous waste drain tank receives and collects potentially radioactive liquid waste from various sources. By original design, the liquid in the miscellaneous waste drain tank was pumped to the waste evaporator. The skid mounted demineralizer now processes liquid radwaste while the evaporator is abandoned. The demineralizer skid consists of various filters and demineralizers that remove solid and ionic impurities from the liquid. From the skid, liquid is pumped through one of two miscellaneous waste monitor tank filters and is collected in the miscellaneous liquid waste monitor tank. From the monitor tank, liquid is pumped in a controlled manner to the collection box. The detergent waste drain tank receives and collects potentially radioactive liquid waste from lab sinks, detergent drains, hot shower drains, and the decontamination area. The liquid contents of the detergent waste drain tank are normally processed through the demineralizer skid. Liquid from the detergent waste drain tank may alternatively be pumped to the collection box after sampling and analysis, depending on sample results.

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

2.3.3.21.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.21, USAR Section 11.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.21-01 dated March 18, 2011, the staff noted that on license renewal drawing LR-M039A, Revision 1, Location E-8, license renewal Note B "[c]omponents beyond the highlighting are in the condensate demineralizer system and are not within the scope of license renewal." The staff questioned if the piping and components beyond this point occupy a space containing components in-scope for 10 CFR 50.4(a)(1) and, therefore, would be required to be in-scope for spatial interaction. The staff requested the applicant to justify its exclusion of the components beyond license renewal Note B from the scope of license renewal.

In its response dated April 15, 2011, the applicant stated that additional piping components upstream of license renewal Note B on license renewal boundary drawing LR-M039A, Revision 1, have been determined to be located in the auxiliary building. The applicant stated that these valves and associated piping are within the scope of license renewal and subject to an AMR. The applicant further stated that license renewal drawing LR-M039A has been revised to include these components within scope and that Note B on license renewal drawing LR-M039A has also been revised to reflect that the piping and components beyond the additional highlighting are in the turbine building and not in-scope.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.21-01 acceptable because the applicant revised drawing LR-M-039A to include those components located in the auxiliary building as in-scope. Component types within the added highlighting are already addressed in LRA Table 2.3.2-21. Therefore, the staff’s concern described in RAI 2.3.3.21-01 is resolved.

In RAI 2.3.3.21-02 dated March 18, 2011, the staff identified an issue with license renewal Note 8 on drawing LR-M039B, Revision 1, Location E-3, downstream of Valve WM142, which states that “[c]omponents beyond the highlighting are not in the scope of license renewal.” The staff questions if these components occupy a space containing components in-scope for 10 CFR 50.4(a)(1) and would, therefore, be required to be in-scope for spatial interaction. The staff requested the applicant to justify its exclusion of the components downstream of Valve WM142 from scope of license renewal.

In its response dated April 15, 2011, the applicant stated that the line downstream of Valve WM142 is the miscellaneous waste evaporator tank gaseous vent path to the station vent. The applicant stated that the components in this nonsafety-related vent path do not contain fluid and are not within the scope of license renewal.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.21-02 acceptable because the components downstream of Valve WM142 are nonsafety-related, do not contain fluids, and are, therefore, not in-scope. Therefore, the staff’s concern described in RAI 2.3.3.21-02 is resolved.

In RAI 2.3.3.21-03 dated March 18, 2011, the staff noted on license renewal drawing LR-M037C, Revision 0, Location K-12, an $1^{1}/_{2}$"-HSC-109 line to be continued from license renewal drawing LR-M037D as within the scope of license renewal. However, drawing LR-M037D, Location C-1, shows this piping as not within the scope of license renewal. The staff requested the applicant to provide additional information to clarify the scoping classification of this pipe section.

In its response dated April 15, 2011, the applicant stated line $1^{1}/_{2}$"-HSC-109 is isolated from the miscellaneous liquid radwaste system at normally closed Valves WC101, WC102, WM94, WC176, WC177, DW15, and DW16. The applicant also stated that because line $1^{1}/_{2}$"-HSC-109 is isolated from sources of water or steam, the components in the line were re-evaluated as having an internal environment of air and are not considered to be within the scope of license renewal for 10 CFR 54.4(a)(2). The applicant further stated that drawing LR-M037C was revised to remove the highlighting from this line and that Note C was also revised for clarification.

In a supplemental response to RAI 2.1-3, “Abandoned Equipment,” dated March 9, 2012, the applicant submitted the results of their actions to ensure that abandoned equipment was identified, isolated, and drained. The applicant’s inspection of abandoned equipment determined that the components associated with the abandoned degasifier skid, miscellaneous waste evaporate skid, evaporator storage tank pumps, and primary water transfer pumps either contained fluid or were not sufficiently isolated to remain drained. As a result, line 1½"-HSC-109 and other components were added to the scope of license renewal and screened for AMR. LRA Section 2.3.3.21 was revised to include additional license renewal boundary drawings, and LRA Table 2.3.3-21 was revised to include 12 new component types.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.21-03, as revised by the supplemental response to RAI 2.1-3, acceptable because the line in question has been included in scope under 10 CFR 50.54(a)(2). Therefore, the staff’s concern described in RAI 2.3.3.21-03 is resolved. The staff reviewed the changes to the scoping boundary provided in the supplemental response to RAI 2.1-3 and found that the applicant has identified the full extent of the license renewal scoping boundary. The staff reviewed the revised license renewal boundary drawings and concluded that all additional components subject to an AMR were captured in the revision to LRA Table 2.3.3-21.

2.3.3.21.3 Conclusion

The staff reviewed the LRA, USAR, and RAI responses, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff’s review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the miscellaneous liquid radwaste system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.22 Nitrogen Gas System

2.3.3.22.1 Summary of Technical Information in the Application

The nitrogen gas system supplies nitrogen to various plant components from two primary sources—the cryogenic nitrogen storage system and the high-pressure nitrogen storage system. Nitrogen is used as a cover gas on components to exclude oxygen, and pressurizing tanks and demineralizers act as the motive force for expelling the tank’s contents.

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

2.3.3.22.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.22, USAR Figure 7.3-9, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff’s review identified an area in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAI, as discussed below.

In RAI 2.3.3.22-01 dated March 18, 2011, the staff noted that on drawing LR-M019, Revision 0, Locations E/F-14 and K-1, electrical penetrations P1C 5SX, P1L 5WX and P2L 2CX are shown as not within the scope of license renewal. However, similar electrical penetrations at locations A-D-14 and E-F-1 are shown as in-scope for license renewal to the upstream check valve. The staff requested the applicant to justify its exclusion of electrical penetrations PIC 5SX, PIL5WX and P2L 2CX from the scope of license renewal.

In its response dated April 15, 2011, the applicant stated that electrical penetrations PIC 5SX, PIL5WX and P2L 2CX are Conax penetration modules as compared to the others, which are Amphenol penetration modules. The applicant stated that the safety-related boundary for a Conax penetration does not extend beyond the electrical penetration to the upstream check valve in the nitrogen system supply line and is, therefore, not within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.22-01 acceptable because the different designs of the electrical penetrations affects boundary locations. The safety-related boundary for an Amphenol penetration extends to the check valve of the nitrogen system, whereas the safety-related boundary for a Conax penetration does not extend beyond the penetration. Therefore, the staff's concern described in RAI 2.3.3.22-01 is resolved.

2.3.3.22.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant appropriately identified the nitrogen gas system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.23 Process and Area Radiation Monitoring System

2.3.3.23.1 Summary of Technical Information in the Application

The process and area radiation monitoring system includes the process radiation monitoring system and the area radiation monitoring system. The process radiation monitoring system is designed to continuously detect, compute, display, and record the level of radioactivity in certain processes and all effluent pathways. The system also provides alarms in the control room and other designated areas when the radioactivity level increases beyond the set point of the monitors. It also initiates protective functions to maintain process and effluent radioactivity levels within acceptable limits.

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

2.3.3.23.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.23 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.23.3 Conclusion

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

2.3.3.24 Reactor Coolant Vent and Drain System

2.3.3.24.1 Summary of Technical Information in the Application

The reactor coolant vent and drain system perform the following functions:

- consolidate radioactive effluents from many sources
- convey the gaseous effluent outside containment to the gaseous radwaste system
- convey fluid drained from the RCS and core flooding system out of containment to the reactor coolant drain tank
- convey effluents released from both the pressurizer and post-accident sampling system to the pressurizer quench tank

Following a safety features actuation system actuation or LOCA, the reactor coolant vent and drain system serves a containment isolation purpose.

The reactor coolant vent and drain system includes the reactor coolant drain tank and containment vent header system and the pressurizer quench tank system. The main components of the system are the reactor coolant drain tank, pressurizer quench tank, quench tank cooler, piping, valves, tank circulation pumps, and rupture discs.

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

2.3.3.24.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.24 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.24.3 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 that the applicant appropriately identified the reactor coolant vent and drain system components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the reactor coolant vent and drain system components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.25 Sampling System

2.3.3.25.1 Summary of Technical Information in the Application

The sampling system includes the reactor coolant sampling system, post-accident sampling system, feedwater sampling system,, and steam sampling system. The sampling system provides capability to sample the RCS, DHR system, and letdown system from the makeup and purification system.

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

2.3.3.25.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.25, USAR Section 9.3.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs, as discussed below.

In RAI 2.3.3.25-01 dated March 18, 2011, the staff noted on license renewal drawing LR-M-042C, Location E-2, Line $^{3}/_{4}$"-HCC-112 continuing from drawing M-031C, Location C-4 as within the scope of license renewal; however, the same line is shown as not within the scope of license renewal on drawing LR-M-031C. The applicant was asked to provide additional information to clarify the scoping classification of this pipe section.

In its response dated April 15, 2011, the applicant identified the ¾"-HCC-112 line shown on LR-M-042C as a vent line containing a gas internal environment and, therefore, not within the scope of license renewal for 10 CFR 54.4(a)(2). A revised drawing with the removed highlighting and an added license renewal note was also provided by the applicant.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.25-01 acceptable because the ¾"-HCC-112 line is a vent line with a gas internal environment and is not required to be within the scope of license renewal. The drawing was updated accordingly. Therefore, the staff's concern described in RAI 2.3.3.25-01 is resolved.

In RAI 2.3.3.25-02 dated March 18, 2011, the staff stated that on license renewal drawing LR-M-042B, Revision 0, Location E-8, a sample line (sample No. S-039-6) was noted as not within the scope of license renewal; however, on drawing LR-M039B this sample line is shown as within the scope of license renewal starting at Location H-7 and returning at Location E-4. The staff requested that the applicant provide additional information to clarify the scoping classification of this pipe section.

In its response dated April 15, 2011, the applicant stated that the sample line (sample No. S-039-6) on drawing LR-M-042B at Location E-8 should be within the scope of license renewal. A revised drawing with updated highlighting was provided. LRA Table 3.3.2-25 was also revised to include a "raw water" environment.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.25-02 acceptable because the sample line in question was added to the scope of license renewal. The staff confirmed the applicant updated the necessary drawings and LRA tables. Therefore, the staff's concern described in RAI 2.3.3.25-02 is resolved.

2.3.3.25.3 Conclusion

The staff reviewed the LRA, USAR, and RAI responses, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant appropriately identified the sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the sampling system components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.26 Service Water System

2.3.3.26.1 Summary of Technical Information in the Application

The service water system is designed to supply cooling water to the component cooling heat exchangers, containment air coolers, and cooling water heat exchangers in the turbine building during normal operation and to provide a redundant supply path to the ESF components during an emergency. The system consists of service water pumps, a dilution pump, motor-operated strainers, and associated piping and valves.

LRA Table 2.3.3-26 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.26.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.26, USAR Section 9.2.1, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

In RAI 2.3.3.26-01 dated March 18, 2011, the staff stated that on license renewal drawing LR-M041A, Revision 0, Location K-5, the continuation of a $^{3}/_{8}$ in. HBD piping from Dilution Pump P180 is shown within the scope of license renewal. Contrary to the information in bullet 3 on page 2.3-129 of the LRA, the $^{3}/_{8}$ in. HBD piping is not shown as a rubber hose on drawing LR-M041A. The staff requested the applicant to provide clarification as to whether the $^{3}/_{8}$-in. HBD line is pipe or rubber hose.

In its response dated April 15, 2011, the applicant stated that the $^{3}/_{8}$-in. HBD continuation piping from dilution pump P180 on drawing LR-M041A, Revision 0, Location K-5, is a pipe and not a rubber hose. The applicant revised LRA Section 2.3.3.26 to delete the words "dilution pump."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.26-01 acceptable because the dilution pump continuation is correctly shown on the drawing as a pipe, and the LRA section has been corrected. Therefore, the staff's concern described in RAI 2.3.3.26-01 is resolved.

2.3.3.26.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant appropriately identified the service water supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the service water supply system components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.27 Spent Fuel Pool Cooling and Cleanup System

2.3.3.27.1 Summary of Technical Information in the Application

The spent fuel pool cooling and cleanup system functions are to remove the decay heat generated by spent fuel stored in the pool as a result of normal refueling conditions and to provide purification of the spent fuel cooling water. The DHR function is accomplished by recirculating spent fuel cooling water from the spent fuel pool through the spent fuel pool pumps, the spent fuel cooling heat exchangers, and then back to the pool. The spent fuel pool pumps take suction from the pool, circulate the pool water through the tubeside of two heat exchangers, and discharge back to the pool. The cleanup function is accomplished by a bypass purification system, in which the bypass loop branches off from the spent fuel pool pump discharge cross-connect line, bypassing the heat exchangers. After demineralizing and filtering, the bypass flow is directed into the normal line downstream of the heat exchanger and returned to the pool.

LRA Table 2.3.3-27 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.27.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.27 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.27.3 Conclusion

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

2.3.3.28 Spent Resin Transfer System

2.3.3.28.1 Summary of Technical Information in the Application

A spent resin storage tank receives and collects spent resin from various demineralizers. A spent resin tank overflow pump transfers excess liquid from the storage tank, through a spent resin tank strainer, to the miscellaneous waste drain tank. One of two spent resin transfer pumps is used to transfer spent resin from the spent resin storage tank through the drumming station to a high integrity container. Two resin fill tanks are used to fill demineralizers with fresh resin. The spent resin is transferred directly to a high integrity container, which is placed inside a transfer cask to reduce radiation levels to operating personnel.

LRA Table 2.3.3-28 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.28.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.28 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.28.3 Conclusion

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

2.3.3.29 Station Air System

2.3.3.29.1 Summary of Technical Information in the Application

The station air system provides clean compressed air for maintenance, testing, fuel oil atomizing, air operated pumps, and other miscellaneous activities. The station air system consists of two station air compressors, each capable of supplying all of the plant station and instrument air requirements. During normal operation, one station air compressor will operate to supply station and instrument air requirements, with the other in standby mode. A temporary air compressor can also be used to feed the station air system through an external isolation valve.

LRA Table 2.3.3-29 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.29.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.29 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.29.3 Conclusion

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

2.3.3.30 Station Blackout Diesel Generator System

2.3.3.30.1 Summary of Technical Information in the Application

The SBODG system function is to supply power to nonessential and essential buses in the event of a SBO. The SBODG has the capability of manually starting and loading from the control room within 10 minutes of this event. There are no automatic start features or loading sequencers associated with the SBODG.

LRA Table 2.3.3-30 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.30.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.30, USAR Section 8.3.1.1.4.2, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs, as discussed below.

In RAI 2.3.3.30-01, dated March 18, 2011, the staff stated that on LRA drawing LR-M017D, Revision 0, Locations G-4 and J-4, an air dryer housing and, at Location E-10, an air intake vibration damper housing were shown within the scope of license renewal. However, the air dryer and vibration damper housings were not included in LRA Table 2.3.3-30, "Station Blackout Diesel Generator System Components Subject to Aging Management Review." The staff requested the applicant to justify the exclusion of these housing components from LRA Table 2.3.3-30.

In its response dated April 15, 2011, the applicant stated that the air dryer housings are evaluated as the component type "Filter Body," and that they are included with that description in Table 2.3.3-30. The applicant also stated that the air intake vibration damper does not have a housing, and is considered a "flexible connection" component type in Table 2.3.3-30.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.30-01 acceptable because the air dryer housings and the air intake vibration damper have been evaluated as component types within Table 2.3.3-30. Therefore, the staff's concern described in RAI 2.3.3.30-01 is resolved.

In RAI 2.3.3.30-02 dated March 18, 2011, the staff stated that in LRA Section 2.3.3.30 in the SBODG jacket water system there is a discussion of two fans that start automatically to cool the radiator cooling coils when needed. In LRA Section 2.3.3.30 the applicant states that "if the fans are out of service, and the SBODG must be run, most of the cooling can be provided by spraying water on the radiator coils. Engine load capacity in this case will have to be limited to prevent engine overheating depending on weather conditions." The spray system components for spraying water on the radiator coils are not identified in the LRA or in Chapter 8 of the USAR. It is not clear to the staff if these components are required to be in-scope for license renewal. The staff requested the applicant to provide a description for the method of spraying down the radiator coils and to clarify if the necessary components are in-scope for license renewal.

In its response dated April 15, 2011, the applicant indicated that the emergency cooling function is not described or discussed in the NRC SERs on SBO, in Davis-Besse correspondence to the

NRC, or in the Davis-Besse USAR. Therefore the components used to spray the SBODG radiation cooling coils are not within the scope of license renewal for the SBO regulated event, in accordance with 10 CFR 54.4(a)(3), because they are not part of the Davis-Besse CLB for the SBO regulated event.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.30-02 acceptable because the components used to spray the SBODG radiator cooling coils are not relied on in safety analyses to perform a function to support the SBO regulated event; therefore, they are not within the scope of license renewal, in accordance with 10 CFR 54.4(a)(3). Therefore, the staff's concern described in RAI 2.3.3.30-02 is resolved.

In RAI 2.3.3.30-03, dated March 18, 2011, the staff noted on license renewal drawing LR-M017D, Revision 0, Locations H-4 and K-4, check valves DA205 and DA204, respectively, that are needed to maintain pressure in the air receiver tanks for the SBODG air start system. The 1-in. pipelines currently end the scoping boundary at manually operated, normally open ball valves DA207 and DA206, while check valves DA205 and DA204 are not included within the boundary. The check valves typically function to maintain air pressure in the air receiver tank. An example of check valves in-scope on similar air receiver tanks is shown on LRA drawing LR-M017B, Revision 0, at locations C-5, E-G, G-6 and J-5. The staff requested the applicant to provide an explanation as to why the license renewal boundaries do not extend to the DA205 and DA204 check valves.

In its response dated April 15, 2011, the applicant stated that the license renewal evaluation boundaries for the SBODG system do not extend to the DA205 and DA204 check valves because the check valves are not required to be in-scope under 10 CFR 54.4(a)(3). The scoping requirement for 10 CFR 54.4(a)(3) includes the main flowpath that performs the regulated event and branch lines up to the first isolation valve. Valves DA205 and DA204 are located in branch lines in which valves DA206 and DA207 form the first isolation valve.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.30-03 acceptable because the ball valves DA206 and DA207 provide an acceptable 10 CFR 50.44(a)(3) scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.30-03 is resolved.

2.3.3.30.3 Conclusion

The staff reviewed the LRA, USAR, and RAI responses, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant appropriately identified the SBODG system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the mechanical components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.31 Station Plumbing, Drains, and Sumps System

2.3.3.31.1 Summary of Technical Information in the Application

The station plumbing, drains, and sumps system consists of sumps, sump pumps, check valves, and drains.

The sumps and associated sump pumps are designed to handle normal drainage, such as equipment drainage, small pipe leaks, and partial fire suppression system actuations. Flood rooms accept the excess flow until the sump pumps can pump the excess volume to the miscellaneous waste drain tank or, if full, to the clean waste receiver tank.

A wafer check valve, installed in all drain lines in negative pressure areas of the auxiliary building that communicate with atmospheric pressure areas, is normally in the horizontal closed position to maintain the differential pressure boundary.

Drain lines from the negative pressure area of the annulus go to auxiliary building sump 1, which is outside the negative pressure boundary, and ECCS sump 1, which is inside the negative pressure boundary; however, a drain from outside the boundary ties into the annulus drain line. The annulus drain lines are provided with swing-type check valves normally held closed, opening when there is a minimal head of water in the drain line providing the required isolation for the negative pressure boundary. Duplex pumps are installed in each sump allowing pump starts to be alternated between the two pumps, extending pump life and maintaining equal pump wear.

The containment building drainage system normal sump in the containment vessel is pumped directly into the miscellaneous waste drain tank or, alternatively, may be aligned to be pumped to the clean waste receiver tank. All floor and equipment drains in the containment building, including the containment air cooler drains, discharge to the containment vessel normal sump.

The service water valve room sump collects water from piping leaks in the valve room and service water pipe tunnel to prevent water from flooding safety-related equipment in the service water system. Discharge from the duplex sump pump is directly to the storm sewer.

Sump pumps in the intake structure pump house valve room ensure that water is collected and removed in the event of a postulated pipe break in the service water pipe tunnel so that the safety-related service water pumps are not affected. The intake structure pump house valve room sump pumps discharge directly to the storm drain.

All roof drains are gravity flow and drain to the storm sewer. The plant sewage collects in wet-wells, and the lift stations pump the wet-well contents to the sewage treatment plant for processing.

LRA Table 2.3.3-31 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.31.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.31 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.31.3 Conclusion

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

2.3.3.32 Turbine Plant Cooling Water System

2.3.3.32.1 Summary of Technical Information in the Application

The three TPCW pumps draw suction from the low-level cooling water tank and discharge through two of the three TPCW heat exchangers to the high-level cooling water tank. The water in the high-level cooling water tank drains by gravity through each component of the turbine plant auxiliary equipment served by the TPCW system. As the water drains through each load, heat is transferred from that load to the TPCW system. The warm water then drains by gravity from the individual loads to the low-level cooling water tank. The TPCW system also provides cooling water to the startup feed pump coolers.

LRA Table 2.3.3-32 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.3.32.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.32 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.3.32.3 Conclusion

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

2.3.4 Steam and Power Conversion Systems

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

- LRA Section 2.3.4.1, "Auxiliary Feedwater System"
- LRA Section 2.3.4.2, "Condensate Storage System"
- LRA Section 2.3.4.3, "Main Feedwater System"
- LRA Section 2.3.4.4, "Main Steam System"

2.3.4.1 Auxiliary Feedwater System

2.3.4.1.1 Summary of Technical Information in the Application

The AFW system is designed to provide feedwater to the SGs when the turbine-driven main feedwater pumps are not available or following a loss of normal and reserve electric power. During a station shutdown, the AFW pumps can be used to remove decay heat until the DHR system can be placed in service. The AFW system consists of two steam turbine-driven feedwater pumps, suction and discharge water piping, valves, and associated I&Cs.

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

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1, USAR Section 9.2.7, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below and in RAI 2.3-01, discussed in Section 2.3.3 of the SER.

In RAI 2.3.4.1-01, dated March 18, 2011, the staff noted that on license renewal drawing LR-M006D, Revision 0, Location H-9, piping (6-in. HBD-137) is in-scope of 10 CFR 54.4(a)(2) as nonsafety piping attached to safety-related piping. The scoping boundary ends at the limit of the seismic analysis (S/I flag), but it is not clear if the piping downstream of this point is still within the same space as safety-related components. The staff questioned if this pipe line downstream of the S/I flag interface is fluid filled and located in the vicinity of 10 CFR 54.4(a)(1) components. The staff asked the applicant to provide sufficient information to verify that the not in-scope piping is not located in an area with 10 CFR 54.4(a)(1) components.

In its response dated April 15, 2011, the applicant stated that components beyond the highlighting at Location H-9, are located in the turbine building and are not within the scope of license renewal. For clarification, license renewal drawing LR-M006D was revised to include license renewal note B to clarify that highlighting ends at the turbine building wall. In addition, as documented in SER Section 2.1.4.2.2, the staff reviewed information provided by the applicant in response to RAI 2.1-1. In its response to RAI 2.1-1 the applicant provided its basis to conclude that non-safety SSCs in the vicinity of safety-related SSCs in the turbine building do not meet the criteria for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). In its response, the applicant stated that safety-related SSCs in the turbine building are fail-safe and therefore the failure of a non-safety SSC would not affect the performance of a safety-related function.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-01 acceptable because components in the turbine building in scope for 10 CFR 54.4(a)(1) are fail-safe; therefore, the piping in question does not need to be included in the scope license renewal for spatial interaction. SER Section 2.1.4.2.2 documents the staff's review of the applicant's evaluation of safety-related components in the turbine building related to the response to RAI 2.1-1, dated April 29, 2011. The staff's concern described in RAI 2.3.4.1-01 is resolved.

2.3.4.1.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant appropriately identified the AFW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant adequately identified the AFW system components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4.2 Condensate Storage System

2.3.4.2.1 Summary of Technical Information in the Application

The condensate storage system consists of two condensate storage tanks, supply and return water piping, valves, and associated I&Cs. The condensate storage system condensate storage tanks provide the primary water source for the AFW system.

LRA Table 2.3.4-2 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review did not identify the need for any additional information.

2.3.4.2.3 Conclusion

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

2.3.4.3 Main Feedwater System

2.3.4.3.1 Summary of Technical Information in the Application

The main feedwater system is a closed system with deaeration accomplished in the main condenser and two one-half capacity deaerators. The feed pump system takes suction from the deaerators through two low speed booster pumps driven through gear reduction units from the feed pump driving turbines. The booster pumps discharge into the full speed feed pumps direct-connected to the driving turbines. These turbines are variable speed units controlled by the integrated control system, which controls feedwater flow to the two SGs.

LRA Table 2.3.4-3 identifies the component types within the scope of license renewal and subject to an AMR.

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.3, USAR Section 10.4.7.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI, as discussed below.

In RAI 2.3.4.3-01 dated March 18, 2011, the staff noted that, on license renewal drawing LR-M006D, Revision 0, Locations H-2 and C-14, there are drip rim drains below the motor driven start-up feed pump 1-1, and Auxiliary Feed Pumps P14-1 and P14-2 that are shown as not in-scope for license renewal. These drains may contain fluid and are apparently in an area that contains safety-related components, in which case they would be included within the scope of license renewal under 10 CFR 54.4(a)(2). The staff requested the applicant to explain why the drip rim drain and connected piping are not in-scope of license renewal.

In its response dated April 15, 2011, the applicant stated that drip drains below these pumps are in-scope for license renewal. The applicant revised license renewal drawing LR-M006D to highlight these drip drains. The applicant also revised the LRA to add the component type "Drain Pan" to LRA Tables 2.3.4-1, 2.3.4-3, 3.4.2-1, and 3.4.2-3 and to add the internal environment for the main feedwater system drain piping to LRA Table 3.4.2-3.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-01 acceptable because the drip pans and associated drain piping were added to the scope of license renewal. The staff confirmed the appropriate drawing and LRA tables were updated. The staff's concern described in RAI 2.3.4.3-01 is resolved.

2.3.4.3.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant appropriately identified the main feedwater system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.4 Main Steam System

2.3.4.4.1 Summary of Technical Information in the Application

The main steam system is designed to conduct steam from the SGs to the high-pressure turbine. The main steam system ensures overpressure protection of the SG and allows for cooldown of the primary plant using auxiliary feed and the atmospheric vents when the condenser is not available for cooldown. The main steam system consists of an atmospheric vent valve, safety valves, AFW pump, and associated piping.

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

2.3.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.4, USAR Section 10.3, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs, as discussed below.

In RAI 2.3.4.4-01 dated March 18, 2011, the staff noted that, on license renewal drawing LR-M045, Revision 1, Locations D-12 and D-14, piping to valves SC200 and SC201 from the two SG wet lay-up chemical addition tanks are shown as not in-scope. However, these tanks, as well as additional piping lines connected to the tanks, are shown as in-scope for 10 CFR 54.4(a)(2). The staff requested the applicant to justify its exclusion of the $^{3}/_{4}$-in. piping to valves SC200 and SC201 from the scope of license renewal.

In its response dated April 15, 2011, the applicant stated that the piping to valves SC200 and SC201 from the SG wet lay-up chemical addition chemical addition tanks does not contain liquid or steam and is not within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-01 acceptable because this piping does not contain liquid or steam and is, therefore, not within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.4.4-01 is resolved.

In RAI 2.3.4.4-02 dated March 18, 2011, the staff noted that, on license renewal drawing LR-M-045, Revision 1, Locations E-11 and E-13, anti-siphon devices downstream of the SG wet lay-up chemical addition metering pumps 1-1 and 1-2 are shown as not in-scope. The piping to which these components are attached is in-scope for 10 CFR 54.4(a)(2). The staff requested the applicant to explain why the anti-siphon devices are not in-scope and not listed as a component type in LRA Table 2.3.4-4, "Main Steam System Components Subject to Aging Management Review."

In its response dated April 15, 2011, the applicant stated the anti-siphon devices are within the scope of license renewal and subject to an AMR. License renewal drawing LR-M045 was revised to include highlighting of the anti-siphon devices. LRA Tables 2.3.4-4, "Main Steam System Components Subject to Aging Management Review," and 3.4.2-4, "Aging Management Review Results—Main Steam System," were amended to include these components.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-02 acceptable because the anti-siphon devices were added as in-scope components. The staff reviewed the revised drawing and aging management tables. Therefore, the staff's concern described in RAI 2.3.4.4-02 is resolved.

2.3.4.4.3 Conclusion

The staff reviewed the LRA, USAR, and RAI responses, and license renewal boundary drawings to determine whether the applicant identified all components within the scope of license renewal. In addition, the staff's review determined whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes the applicant 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 adequately identified the mechanical components subject to an AMR, in accordance with the requirements of 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:

- containment (including containment vessel, shield building, and containment internal structures)
- auxiliary building

- intake structure, forebay, and service water structures
- BWST level transmitter building
- miscellaneous DG building
- office building (condensate storage tanks)
- personnel shop facility passageway (missile shield area)
- service water pipe tunnel and valve rooms
- SBODG building (including Transformer X-3051 and radiator skid foundations)
- turbine building
- water treatment building
- yard structures
- containment access facility
- personnel shop facility (including elevated walkway)

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 met 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, which 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).

In its scoping 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 USAR for each structure to determine if the applicant omitted components with intended functions delineated under 10 CFR 54.4(a) from the scope of license renewal. The staff also reviewed the USAR to determine if all intended functions delineated under 10 CFR 54.4(a) were specified in the LRA. The staff asked for additional information to resolve any omissions or discrepancies.

After completing 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 if the functions are performed with moving parts or a change in configuration or properties or 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). The staff asked for additional information to resolve any omissions or discrepancies.

2.4.1 Containment (including Containment Vessel, Shield Building, and Containment Internal structures)—Seismic Class I

2.4.1.1 Summary of Technical Information in the Application

The Seismic Class I containment consists of three basic structures—a free-standing steel containment vessel, a reinforced concrete shield building, and the internal structures. The containment vessel is a cylindrical steel pressure vessel with a hemispherical dome and ellipsoidal bottom. It is completely enclosed by a reinforced concrete shield building having a cylindrical shape with a shallow dome roof. The containment vessel and shield building are supported on a concrete foundation founded on a firm rock structure. The containment interior structures internal to the containment vessel include, but are not limited to, the following:

- primary shield structure, forming the reactor cavity
- secondary shield structure, forming the SG compartments and the peripheral shield walls
- polar crane
- reactor service crane
- refueling canal and fuel handling bridge
- platforms and floors
- elevator shaft and stairway
- nuclear steam supply system (NSSS) components, supports, and restraints
- pipe supports and restraints
- missile shields and jet impingement barriers

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

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.1.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the containment 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

The auxiliary building is a Seismic Class I structure with steel framing and reinforced concrete walls, roofs, and floors. It is a five-story building with two levels below grade. The radioactive waste (radwaste) systems are housed in the basement. The remainder of the building is used for fuel storage and handling, the control room, switchgear, EDGs, air handling systems, and other operational facilities.

The auxiliary building is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1). The auxiliary building shelters and protects nonsafety-related SSCs whose failure could prevent performance of a safety-related function. Therefore, it is within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2). The auxiliary building is relied upon to demonstrate compliance with the SBO (10 CFR 50.63) and fire protection (10 CFR 50.48) rules. Therefore, it is within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3).

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 and the USAR 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 2.4.2, the staff found an area in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the auxiliary building.

By letter dated February 28, 2011, the staff issued RAI 2.4.2-1, requesting that the applicant confirm the inclusion, or justify the exclusion, of the cable trays, electrical panels, electrical cabinets, instrumentation panels and racks, and fire barrier coatings and wraps. The staff stated that based on its review of LRA Section 2.4.2 and LRA Table 2.4-2, it was not clear if these SCs were within the scope of license renewal and subject to an AMR.

In its response dated March 23, 2011, the applicant stated that "cable trays, electrical panels, electrical cabinets, instrumentation panels and racks, and fire barrier coatings (i.e., fireproofing) and wraps for auxiliary building are evaluated as a bulk commodities in LRA Section 2.4.13." The applicant also stated that "as provided in LRA Section 2.4.13, these bulk commodities are within the scope of license renewal and subject to an AMR." The staff finds the applicant's response acceptable because it clarified that cable trays, electrical panels, electrical cabinets, instrumentation panels and racks, and fire barrier coatings (i.e., fireproofing) and wraps for the auxiliary building are evaluated as bulk commodities in LRA Section 2.4.13. Therefore, the staff's concern described in RAI 2.4.2-1 is resolved.

2.4.2.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant 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 Intake Structure, Forebay, and Service Water Structures

2.4.3.1 Summary of Technical Information in the Application

The intake structure is a Seismic Class I structure of reinforced concrete construction. Each of the three main service water pumps is housed in an individual cell, and each cell is designed to include such features as removable sliding screens for debris control and stop logs (gates) for dewatering cells during maintenance work. The intake structure is supported on a mat foundation bearing on bedrock. The forebay, approximately 700 feet long, impounds a body of water that serves as a heat sink. The dikes on each side are classified and designed as Seismic Class I structures. Steel sheet pilings and concrete retaining walls provide slope stability at the forebay area near the intake structure. The service water discharge structure is a partially buried concrete structure located on the intake channel dike and discharges to the south side of the forebay. The service water discharge structure consists of a concrete end-wall, slab, and spillway. A buried 42-in. diameter concrete pipe sleeve encases the service water discharge piping below the forebay dike.

LRA Table 2.4-3 identifies the components subject to an AMR for the intake structure, forebay, and service water structures by component type and intended function.

2.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4.3 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 2.4.3, the staff found an area in which additional information was necessary to complete the evaluation of the applicant’s scoping and screening results for the intake structure, forebay, and service water structures.

By letter dated February 28, 2011, the staff issued RAI 2.4.3-1, requesting that the applicant confirm the inclusion, or justify the exclusion, of the water stops, instrumentation panels and racks, and fire barrier coatings and wraps. The staff stated that based on its review of LRA Section 2.4.3 and LRA Table 2.4-3 it was not clear if these SCs were within the scope of license renewal and subject to an AMR.

In its response dated March 23, 2011, the applicant stated that the water stops, instrumentation panels and racks, and fire barrier coatings (i.e., fireproofing) and wraps for the intake structure, forebay, and service water structures are evaluated as bulk commodities in LRA Section 2.4.13 and, therefore, are within the scope of license renewal and subject to an AMR. The staff finds the applicant’s response acceptable because it clarified that the water stops, instrumentation panels and racks, and fire barrier coatings (i.e., fireproofing) and wraps for the intake structure, forebay, and service water structures are included within the scope of license renewal and subject to an AMR as bulk commodities in LRA Section 2.4.13. Therefore, the staff’s concern described in RAI 2.4.3-1 is resolved.

2.4.3.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the intake structure, forebay, and service water 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).

2.4.4 Borated Water Storage Tank Level Transmitter Building

2.4.4.1 Summary of Technical Information in the Application

The BWST level transmitter building is a Seismic Class II structure located adjacent to the BWST. It houses and protects safety-related components associated with the BWST. The BWST level transmitter building is a shed-like structure that consists of steel beam framing with metal siding and roof. The steel framing is supported by reinforced concrete piers. The building has a gravel floor.

The BWST level transmitter building contains safety-related components, as identified in the plant configuration database. The BWST level transmitter building is a Seismic Class II structure located adjacent to the Seismic Class I BWST and contains safety-related components; therefore, it meets the 10 CFR 54.4(a)(2) scoping criteria.

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

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.4.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the BWST level transmitter 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 Miscellaneous Diesel Generator Building

2.4.5.1 Summary of Technical Information in the Application

The miscellaneous DG building is located north of the water treatment building. The structure is a single-story structure constructed of concrete masonry units on a concrete slab at grade. The yard is designated as a fire area to ensure safe shutdown with a fire outside or in miscellaneous buildings, such as the miscellaneous diesel building, which contain cables that might affect safe shutdown, such as the cable bus to the 13.8-kilovolt (kV) to 4.16-kV transformer. A credited 3-hour interior fire wall separates the miscellaneous diesel room and the oil tank room within the miscellaneous DG building. The miscellaneous DG building contains credited fire barriers relied upon to demonstrate compliance with the fire protection (10 CFR 50.48) regulated event. This meets the 10 CFR 54.4(a)(3) scoping criteria.

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

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.5 and the USAR 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 found an area in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the miscellaneous DG building.

By letter dated February 28, 2011, the staff issued RAI 2.4.5-1. The staff requested the applicant to supply additional information to confirm the inclusion, or justify the exclusion, of the compressible joints and seals, and fire barrier coatings and wraps. The staff stated that it was not clear if those components were included in LRA Table 2.4-5 and, therefore, within the scope of license renewal and subject to an AMR.

In its response dated March 23, 2011, the applicant stated that the compressible joints and seals for the miscellaneous DG building are evaluated as bulk commodities in LRA Section 2.4.13. The applicant stated that as provided in LRA Section 2.4.13, these bulk commodities are within the scope of license renewal and subject to an AMR. The applicant also stated that there are no fire barrier coatings (i.e., fireproofing) and wraps within the scope of license renewal that are associated with the miscellaneous DG building. The staff finds the applicant's response acceptable because the applicant clarified that: (1) the compressible joints and seals, for miscellaneous DG building are evaluated as bulk commodities in LRA Section 2.4.13 and, therefore, are within the scope of license renewal and subject to an AMR and (2) there are no fire barrier coatings (i.e., fireproofing) and wraps within the scope of license renewal that are associated with the miscellaneous DG building. Therefore, the staff's concern described in RAI 2.4.5-1 is resolved.

2.4.5.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the miscellaneous DG 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 Office Building (Condensate Storage Tanks)

2.4.6.1 Summary of Technical Information in the Application

The office building (condensate storage tanks) is a Seismic Class II structure with steel framing, reinforced concrete floors and walls, vertical window wall exterior panels and precast concrete exterior wall panels. The structure is supported by reinforced concrete caissons that are socketed into and bear directly on bedrock. The office building provides an enclosure for the two nonsafety-related condensate storage tanks and associated piping. The condensate storage tanks provide the primary water source for the AFW system. The office building also contains rated fire barriers credited for safe shutdown analysis. The turbine-driven auxiliary feed pumps provide feedwater to the SGs by taking suction from the condensate storage tanks and are driven by steam from either SG during an SBO event. The office building is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(3).

LRA Table 2.4-6 identifies the components subject to an AMR for the office building by component type and intended function.

2.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.4.6 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.6.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the office 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).

2.4.7 Personnel Shop Facility Passageway (Missile Shield Area)

2.4.7.1 Summary of Technical Information in the Application

The missile shield portion of the personnel shop facility passageway is within the scope of license renewal. The safety-related personnel shop facility passageway missile shield area provides missile protection to the auxiliary building. This meets the 10 CFR 54.4(a)(1) scoping criteria. The personnel shop facility passageway missile shield area shelters and protects nonsafety-related SSCs whose failure could prevent performance of a safety-related function. Therefore, it meets the 10 CFR 54.4(a)(2) scoping criteria.

LRA Table 2.4-7 identifies the components subject to an AMR for the personnel shop facility passageway by component type and intended function.

2.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.4.7 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.7.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the personnel shop facility passageway 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 Service Water Pipe Tunnel and Valve Rooms

2.4.8.1 Summary of Technical Information in the Application

The service water pipe tunnel is located between the auxiliary building and the intake structure; Valve Room No. 1 is located adjacent to the auxiliary building in the turbine building; and Valve Room No. 2 is located adjacent to the intake structure. The service water pipe tunnel and valve rooms are within the scope of license renewal as safety-related structures, which meet the criteria of 10 CFR 54.4(a)(1). The service water pipe tunnel and valve rooms shelter and protect the nonsafety-related SSCs whose failure could prevent performance of a safety-related function, which meet the criteria of 10 CFR 54.4(a)(2). The service water pipe tunnel and valve rooms contain credited fire barriers relied upon to demonstrate compliance with the fire protection (10 CFR 50.48) rule. This meets the 10 CFR 54.4(a)(3) scoping criteria.

LRA Table 2.4-8 identifies the components subject to an AMR for the service water pipe tunnel and valve rooms by component type and intended function.

2.4.8.2 Staff Evaluation

The staff reviewed LRA Section 2.4.8 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.8.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the service water pipe tunnel and valve room 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 Station Blackout Diesel Generator Building (including Transformer X-3051 and Radiator Skid Foundations)

2.4.9.1 Summary of Technical Information in the Application

The SBODG serves as the alternate AC source for SBO. The SBODG building is a prefabricated building with spread footings for building columns and grade beams for the perimeter walls. It is a Seismic Class II structure with an independent reinforced concrete foundation for the DG. The structure houses, supports and protects the SBODG and its supporting equipment. The Transformer X-3051 foundation is a reinforced concrete slab on grade. The function of the SBODG building is to provide physical support for equipment relied upon to demonstrate compliance with the SBO rule (10 CFR 50.48) and for recovery from an SBO, as defined in 10 CFR 50.2. This meets the 10 CFR 54.4(a)(3) scoping criteria.

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

2.4.9.2 Staff Evaluation

The staff reviewed LRA Section 2.4.9 and the USAR 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 2.4.9, the staff found an area in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the SBODG building.

By letter dated February 28, 2011, the staff issued RAI 2.4.9-1, requesting that the applicant confirm the inclusion, or justify the exclusion, of the compressible joints and seals and fire barrier coatings and wraps. The staff stated that it was not clear if these SCs were within the scope of license renewal and subject to an AMR.

In its response dated March 23, 2011, the applicant stated that the compressible joints and seals for the SBODG building are evaluated as bulk commodities in LRA Section 2.4.13. The applicant stated that these bulk commodities are within the scope of license renewal and subject to an AMR. The applicant also stated that there are no fire barrier coatings (i.e., fireproofing) and wraps within the scope of license renewal that are associated with the SBODG building and that the SBODG was installed to meet the SBO rule. The applicant further stated that the SBODG was installed after completion of the Appendix R analysis and no credit for the DG was taken in the fire hazard analysis report. Therefore, there are no fire barrier coatings (i.e., fireproofing) or wraps associated with the SBODG building that perform an intended function for the fire protection regulated event. The staff finds the applicant's response acceptable because it clarified that the compressible joints and seals for the SBODG building are evaluated as bulk commodities in LRA Section 2.4.13, and there are no fire barrier coatings (i.e., fireproofing) or wraps associated with the SBODG building that perform an intended function for the fire protection regulated event. Therefore, the staff's concern described in RAI 2.4.9-1 is resolved.

2.4.9.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the SBODG 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 Turbine Building

2.4.10.1 Summary of Technical Information in the Application

The turbine building is a Seismic Class II structure with steel framing, exterior metal siding, metal roof deck, and floors of reinforced concrete or steel grating. The structure is supported by concrete caissons and, in some areas, a mat foundation bearing on bedrock. Two 190-ton capacity bridge cranes are provided to service the building and equipment. The turbine building is a Seismic Class II structure adjacent to the auxiliary building and contains safety-related components; therefore, it meets the criteria of 10 CFR 54.4(a)(2). The turbine building contains credited fire barriers and provides physical support to portions of the fire protection piping relied upon to demonstrate compliance with the fire protection regulated event (10 CFR 50.48). This meets the 10 CFR 54.4(a)(3) scoping criteria.

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

2.4.10.2 Staff Evaluation

The staff reviewed LRA Section 2.4.10 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.10.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant 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).

2.4.11 Water Treatment Building

2.4.11.1 Summary of Technical Information in the Application

The water treatment building is a Seismic Class II structure with steel framing, reinforced concrete or steel grated floors, and metal roof deck. The structure is supported on a mat foundation bearing directly on bedrock. The function of the water treatment building is to provide physical support and protection for equipment used for the fire protection regulated event criteria in 10 CFR 50.48. This meets the criteria of 10 CFR 54.4(a)(3).

LRA Table 2.4-11 identifies the components subject to an AMR for the water treatment building by component type and intended function.

2.4.11.2 Staff Evaluation

The staff reviewed LRA Section 2.4.11 and the USAR 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 2.4.11, the staff found an area in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the water treatment building.

By letter dated February 28, 2011, the staff issued RAI 2.4.11-1, which requested the applicant to confirm the inclusion, or justify the exclusion, of the caulking and sealant, compressible joints and seals, and fire barrier coatings and wraps. The staff stated that it was not clear if these SCs were included in LRA Table 2.4-11 and within the scope of license renewal and subject to an AMR.

In its response dated March 23, 2011, the applicant stated that the caulking and sealant are evaluated as part of the compressible joints and seals commodities. The applicant stated that the compressible joints and seals for the water treatment building are evaluated as bulk commodities in LRA Section 2.4.13 and, therefore, are within the scope of license renewal and subject to an AMR. The applicant also stated that there are no fire barrier coatings (i.e., fireproofing) and wraps within the scope of license renewal that are associated with the water treatment building. The staff finds the applicant's response acceptable because it clarifies that the compressible joints and seals for the water treatment building are evaluated as bulk commodities in LRA Section 2.4.13 and that there are no fire barrier coatings (i.e., fireproofing) and wraps within the scope of license renewal that are associated with the water treatment building. Therefore, the staff's concern described in RAI 2.4.11-1 is resolved.

2.4.11.3 Conclusion

The staff reviewed the LRA, USAR, and RAI response to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the water treatment 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).

2.4.12 Yard Structures

2.4.12.1 Summary of Technical Information in the Application

The yard structures are structures at Davis-Besse not contained within or attached to buildings, such as the shield building, auxiliary building, and turbine building. The yard structures evaluated for license renewal include foundations and structural arrangements for the following:

- BWST Foundation (including trench)—The BWST is designed to Seismic Class I requirements and is located to the west of the auxiliary building. The foundation of the tank is a reinforced concrete mat resting on Class I structural backfill. The BWST foundation (including trench) shelters and protects nonsafety-related SCs whose failure could prevent performance of a safety-related function. Therefore, it meets the 10 CFR 54.4(a)(2) scoping criteria.
- Diesel Oil Pump House—The diesel oil pump house is a reinforced concrete structure located adjacent to the diesel oil storage tank. The diesel oil pump house is designed to Seismic Class II requirements. The function of the diesel oil pump house is to provide physical sheltering and support for the nonsafety-related diesel oil transfer pump and associated components to demonstrate compliance with the fire protection rule (10 CFR 50.48). This meets the 10 CFR 54.4(a)(3) scoping criteria.
- Diesel Oil Storage Tank Foundation—The diesel oil storage tank foundation rests on a reinforced concrete mat, which is also part of the oil spill retention area (retaining area) for the storage tank. The foundation is designed to Seismic Class II requirements and is founded on Seismic Class II structural backfill material. The function of the diesel oil storage tank foundation is to provide physical support for the diesel oil storage tank, which is credited to provide an alternate fuel supply to the EDG day tanks in the event of a postulated fire to demonstrate compliance with the fire protection rule (10 CFR 50.48). This meets the 10 CFR 54.4(a)(3) scoping criteria.
- EDG Fuel Oil Storage Tanks Foundation—The two EDG fuel oil storage tanks are buried and are designed to Seismic Category I requirements. These tanks are supported by a reinforced concrete foundation and are covered with compacted material that qualifies as Seismic Category I structural backfill. The EDG fuel oil storage tanks foundation is within the scope of license renewal as a Seismic Class I structure, which meets the criteria of 10 CFR 54.4(a)(1).

- Fire Hydrant Hose Houses—The fire hydrant hose houses are prefabricated steel sheds with two hinged doors on concrete pier foundations. They provide physical sheltering and support for fire hydrants, which are part of the fire suppression system to demonstrate compliance with the fire protection rule (10 CFR 50.48). This meets the 10 CFR 54.4(a)(3) scoping criteria.
- Fire Wall between Bus-Tie Transformers, between Bus-Tie Transformer and Startup Transformer 01, and between Auxiliary and Main Transformers—The main, auxiliary, bus-tie, and startup transformers are large oil-filled transformers. Between the main and auxiliary transformers, between the main and auxiliary transformers, the bus-tie transformers, and between the bus-tie and startup transformer 01, 3-hour barrier fire walls are provided and credited fire barriers are relied upon to demonstrate compliance with the fire protection rule (10 CFR 50.48). This meets the 10 CFR 54.4(a)(3) scoping criteria.
- Fire Water Storage Tank Foundation—The fire water storage tank is a 300,000 gallon storage tank. The tank, foundation, and subbase are designed to Seismic Class II requirements. The subbase is constructed of earthen materials and compacted to Seismic Class II structural requirements. The fire water storage tank foundation provides physical support for the fire water storage tank, which is the primary fire water supply for the fire suppression system. This meets the 10 CFR 54.4(a)(3) scoping criteria.
- Nitrogen Storage Building—The nitrogen storage building is a single-story steel framed storage structure with reinforced concrete foundation, walls, and a roof. It provides shelter and support to the cryogenic nitrogen storage tank and the high-pressure nitrogen storage system. The nitrogen storage building provides missile protection to the BWST from potential missile sources contained within the nitrogen storage building. This meets the 10 CFR 54.4(a)(2) scoping criteria.
- SBO Components and Structures in the Yard and Switchyard—The SBO component foundations and structures in the yard and switchyard (Startup Transformers 01 and 02; bus-tie transformers; 345-kV switchyard circuit breakers ACB34560, ACB34561, ACB34562, ACB34563 and ACB34564; air break switch ABS34625; Relay House; "J" and "K" buses) are Seismic Class II structures.

  The transformers are supported on wall and column footings. The switchyard breakers are supported by steel frame structures, and the bus support structures are supported by reinforced concrete caisson foundations. The SBO component foundations and structures in the yard and switchyard provide physical support for equipment relied upon to demonstrate compliance with the SBO rule (10 CFR 50.63). This meets the 10 CFR 54.4(a)(3) scoping criteria.
- Wave Protection Dikes—The wave protection dikes are Seismic Class II earthen dikes. Wave protection dike fill material consists of topsoil obtained from the onsite topsoil stockpile. The wave protection dikes provide protection for the Davis-Besse site facilities from wave effects during the maximum credible water level conditions. This meets the 10 CFR 54.4(a)(2) scoping criteria.
- Duct Banks, Cable Trenches, and Manholes—Duct banks, cable trenches, and manholes are installed and routed in the yard to provide physical support and shelter for in-scope electrical components such as electric cables and conduits. They provide physical support and shelter to safety-related equipment and nonsafety-related equipment whose failure could prevent satisfactory accomplishment of required safety

functions, and they provide physical support and shelter to equipment relied upon to demonstrate compliance with the SBO (10 CFR 50.63) and fire protection (10 CFR 50.48) rules. Therefore, they meet the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

LRA Table 2.4-12 identifies the components subject to an AMR for the yard structures by component type and intended function.

2.4.12.2 Staff Evaluation

The staff reviewed LRA Section 2.4.12 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.12.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the 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).

2.4.13 Bulk Commodities

2.4.13.1 Summary of Technical Information

The bulk commodities are structural component groups that support in-scope structures for the mechanical and electrical systems (e.g., anchorages, embedments, instrument panels, racks, cable trays, conduits, fire seals, fire doors, hatches, monorails, equipment, and component supports). They are common to multiple SSCs and share material and environment properties, which allow a common program or inspection to manage their aging effects. The bulk commodities are in-scope based on the equipment that they support or protect because they do the following:

- provide structural or functional support to safety-related equipment to meet the 10 CFR 54.4(a)(1) scoping criteria
- provide structural or functional support to nonsafety-related equipment whose failure could prevent satisfactory accomplishment of required safety functions (includes seismic II/I considerations) to meet the 10 CFR 54.4(a)(2) scoping criteria
- provide structural or functional support required to meet the NRC's regulations for any of the regulated events in 10 CFR 54.4(a)(3) to meet the 10 CFR 54.4(a)(3) scoping criteria

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

2.4.13.2 Staff Evaluation

The staff reviewed LRA Section 2.4.13 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.13.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant adequately identified the bulk 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 Containment Access Facility—Seismic Class II

2.4.14.1 Summary of Technical Information

The containment access facility is a four-story Seismic Class II building located adjacent to the south wall of the auxiliary building and the west wall of the personnel shop facility missile shield area. The building houses engineering and administrative staff offices and provides an access control entry point into the auxiliary building radiologically controlled area. The containment access facility is a steel framed building with exterior walls of steel siding above the first story. The first story has a combination of concrete masonry units and exterior walls of steel siding. The containment access facility is founded on grade walls with seismic ties and caisson piles that extend to bedrock, and it is designed so that the collapse of the building in a seismic event will not prevent the function of any safety-related SSCs. The containment access facility is within the scope of license renewal, based on the criterion of 10 CFR 54.4(a)(2), because is designed not to collapse onto safety-related structures; thus, it will not prevent the safety-related structures from performing their safety functions. The containment access facility does not contain any in-scope components; therefore, the evaluation boundary for the containment access facility includes only the major structural building systems required for overall structural integrity.

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

2.4.14.2 Staff Evaluation

The staff reviewed LRA Section 2.4.14 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.14.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant has adequately identified the containment access facility 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 Personnel Shop Facility (Including Elevated Walkway)—Seismic Class II

2.4.15.1 Summary of Technical Information

The personnel shop facility is a Seismic Class II five-story structure, which houses offices and shop facilities. The personnel shop facility is located south of the turbine building. The foundation consists of reinforced concrete caissons, and the ground floor consists of a reinforced concrete slab on grade. The elevated floors consist of reinforced concrete overlying structural steel-supported metal deck. The roof consists of a metal deck, supported by structural framing steel. The personnel shop facility superstructure consists of structural steel framing with reinforced concrete masonry unit exterior walls up to elevation 606 feet and metal siding above that elevation. The personnel shop facility is within the scope of license renewal, based on the criterion of 10 CFR 54.4(a)(2), because is designed not to collapse onto safety-related structures; thus, it will not prevent the safety-related structures from performing their safety functions. The evaluation boundary for the personnel shop facility includes only the major structural building systems required for overall structural integrity.

LRA Table 2.4-15 identifies the components subject to an AMR for the personnel shop facility by component type and intended function.

2.4.15.2 Staff Evaluation

The staff reviewed LRA Section 2.4.15 and the USAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff's review did not identify the need for any additional information.

2.4.15.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SCs within the scope of license renewal and to determine whether the applicant had identified all SCs subject to an AMR. On the basis of its review, the staff concludes that the applicant has adequately identified the personnel shop facility SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical and Instrumentation and Controls

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

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

The staff's evaluation of the information in the LRA was the same for all electrical and I&C systems. The objective was to determine whether the applicant identified, in accordance with 10 CFR 54.4, components and supporting structures for electrical and I&C systems that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the Davis-Besse UFSAR, for each electrical and I&C system to determine whether the applicant has omitted, from the scope of license renewal, components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the LRA specified all license renewal intended functions in accordance with 10 CFR 54.4(a).

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SSCs with intended functions, the staff sought to determine whether the functions are performed with moving parts or a change in configuration or properties or the SSCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SSCs were subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.1 Electrical and Instrumentation and Controls Commodity Groups

2.5.1.1 Summary of Technical Information in the Application

LRA Section 2.5 describes the electrical and I&C systems. The scoping method includes all plant electrical and I&C components. Evaluation of electrical systems includes electrical and I&C components in mechanical systems. The plant-wide basis approach for the review of plant equipment eliminates the need to indicate each unique component and its specific location and precludes improper exclusion of components from an AMR.

The basic philosophy of the electrical and I&C components IPA is that components are included in the scoping review unless specifically screened out. For the electrical and I&C IPA, the applicant grouped all components into commodity groups of similar electrical and I&C components with common characteristics and by determining component level intended functions of the commodity groups.

The applicant's IPA eliminated commodity groups and specific plant systems from further review as the intended functions of commodity groups were examined. In addition to the plant electrical systems, the applicant conservatively included certain switchyard components required to restore offsite power following an SBO event within the scope of license renewal even though those components are not relied on in the Davis-Besse safety analyses or plant evaluations for functions that demonstrate compliance with the SBO rule (10 CFR 50.63).

The offsite power system provides the electrical interconnection between Davis-Besse and the offsite transmission network. The offsite power sources required to support SBO recovery actions are comprised of transmission conductors (and connections) and switchyard bus (and connections), circuit breakers to the startup transformers and start up transformers to onsite electrical distribution interconnections, control circuits, and structures as shown in Figure 2.5-1 of the LRA.

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

- non-environmentally qualified insulated cables and connections—conduct electricity
- non-environmentally qualified sensitive, high-voltage, low-level signal instrument cables and connections—conduct electricity.
- non-environmentally qualified medium-voltage power cables—conduct electricity
- switchyard bus and connections—conduct electricity

- transmission conductors and connections—conduct electricity
- high-voltage insulators—insulation and support

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5 and USAR Sections 7 and 8 using the evaluation methodology described in 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 USAR 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).

General Design Criteria 17 of 10 CFR Part 50, Appendix A, requires that electric power from the transmission network to the onsite electric distribution system be supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure. In addition, the staff noted that the guidance provided by letter dated April 1, 2002 (ADAMS Accession No. ML020920464), "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the SBO 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 the following:

> 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.

In addition, the aforementioned guidance has been clarified in an ISG document on the SBO recovery path for license renewal to emphasize that the SBO recovery path should include the following:

> The switchyard circuit breakers at transmission system voltage (69 kV [kilovolt] and higher) that connect to the offsite system power transformers, the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical distribution system, and the associated control circuits and structures.

In its application dated August 27, 2010, the applicant described the SBO recovery path that was in the scope of license renewal and included all components starting from transmission line breakers ACB34560, ACB34561, ACB34562, ACB34563, ACB34564, switchyard 345 kV buses, control circuits and protective relays for the switchyard circuit breakers (and the equipment associated with the "J" and "K" buses), disconnect switch ABS34625, and the switchyard relay house (where the switchyard control circuits and relays are located). According to the applicant, startup Transformers 01 and 02 provide the in-scope pathways into the plant and to the safety buses. Startup Transformers 01 and 02 provide a step-down in voltage from 345 kV to 13.8 kV, and the bus-tie transformer steps the voltage down to 4.16 kV just prior to the pathway entering the auxiliary building. The 4.16 kV cable bus enters the auxiliary building and is routed to 4.16 kV essential buses C1 and D1. The power recovery pathway into the plant is comprised of the transmission conductor (and connections) and the switchyard bus (and connections). Consequently, the staff finds that the scope of equipment and components for the SBO recovery path for Davis-Besse is consistent with the GALL Report and, therefore, acceptable. Additionally, the staff finds that Section 2.5.10 of the LRA is consistent with the GALL Report and, therefore, acceptable.

In LRA Sections 2.5.1, 2.5.2, and 2.5.3, the applicant indicated that non-EQ insulated cables and connections were included under the scope of the Davis-Besse AMP. The staff finds that this inclusion is consistent with the GALL Report and, therefore, acceptable.

In LRA Section 2.5.4.1, “Electrical Portion of Electrical and I&C Penetration Assemblies,” the applicant stated that the non-EQ electrical penetrations are subject to an AMR. The staff’s review finds inclusion of non-EQ electrical penetrations in the scope of license renewal consistent with the GALL Report and, therefore, acceptable.

In LRA Section 2.5.3.3 of application, the applicant stated that, based on its review of plant electrical drawings, the fuse documentation, and other engineering documents, the plant fuse holders are either part of an active electrical panel or are located in circuits that perform no license renewal intended function. The staff finds the applicant’s explanation for not including the fuse holders in the scope of license renewal consistent with the GALL Report and, therefore, acceptable.

2.5.1.3 Conclusion

The staff reviewed the LRA and USAR to determine whether the applicant identified all SSCs within the scope of license renewal and to determine whether the applicant had identified all components subject to an AMR. On the basis of its review, the staff concludes that the applicant 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 nonsafety-related SSCs within the scope of license renewal and the SCs requiring an AMR is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

On the basis of its review the staff concludes that the applicant adequately identified those SSCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and those SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) evaluates aging management programs (AMPs) and aging management reviews (AMRs) for Davis-Besse Nuclear Power Station (Davis-Besse), by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff).

In Appendix B of its license renewal application (LRA), FirstEnergy Nuclear Operating Company (FENOC or the applicant) described the 43 AMPs that it relies on to manage or monitor the aging of passive, long-lived structures and components (SCs).

In LRA Section 3, the applicant provided the results of the AMRs for those SCs identified in LRA Section 2 as within the scope of license renewal and subject to an AMR.

3.0 Applicant's Use of the Generic Aging Lessons Learned Report

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

The purpose of the GALL Report is to provide a summary of staff-approved AMPs to manage or monitor the aging of SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for LRA review will be greatly reduced, improving the efficiency and effectiveness of the license renewal review process. The GALL Report also serves as a quick reference for applicants and staff reviewers to AMPs and activities that the staff has determined will adequately manage or monitor aging during the period of extended operation.

The GALL Report identifies the following:

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

To determine whether use of the GALL Report would improve the efficiency of LRA review, the staff conducted a demonstration of the GALL Report process in order to model the format and content of safety evaluations (SEs) based on it. The results of the demonstration project confirmed that the GALL Report process will improve the efficiency and effectiveness of LRA review while maintaining the staff's focus on public health and safety. NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), Revision 1, dated September 2005, was prepared based on both the GALL Report model and lessons learned from the demonstration project.

During the applicant's preparation of its LRA, the staff was in the process of developing and implementing SRP-LR, Revision 2, and the GALL Report, Revision 2. The revisions to these two documents were issued in December 2010. The applicant's LRA was received on August 27, 2010, and, therefore, was not formatted to Revision 2 of the SRP-LR or the GALL Report. The SER was administratively formatted to align with the LRA; therefore, the SRP-LR and the GALL Report numbering of input such as AMR items uses the numbering sequence of Revision 1 for these two documents. However, 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 SRP-LR, Revision 2, dated December 2010; and the guidance provided in the GALL Report, Revision 2, dated December 2010. The staff issued requests for additional information (RAIs) where LRA details differed from changes that were incorporated into Revision 2 of the SRP-LR and the GALL Report. These RAIs and the staff evaluation of the applicant's responses are documented in Sections 3 and 4 of this SER.

In addition to its review of the LRA, the staff conducted an onsite audit of selected AMRs and associated AMPs during the weeks of February 14 and February 21, 2011, as described in the "Audit Report Regarding the Davis-Besse Nuclear Power Station License Renewal Application," dated June 1, 2011. The onsite audits and reviews are designed for maximum efficiency of the staff's LRA review. The applicant can respond to questions, the staff can readily evaluate the applicant's responses, the need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in review efficiency.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that follows the standard LRA format agreed to by the staff and the Nuclear Energy Institute (NEI) by letter dated August 27, 2010. 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 that of SRP-LR Chapter 3. LRA Section 3 presents the results of AMR information in the following two table types:

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

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

The content of the previous LRAs and of the Davis-Besse application is essentially the same. The intent of the revised format of the Davis-Besse LRA was to modify the tables in LRA Section 3 to provide additional information that would assist in the staff's review. In Table 1s, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In Table 2s, the applicant identified the linkage between the scoping and screening results in LRA Section 2 and the AMRs in LRA Section 3.

3.0.1.1 Overview of Table 1s

Each Table 3.x.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables of the GALL Report. The table is essentially the same as Tables 1–6 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 recommended—information or reference to where that information is located
- name of a plant-specific program
- exceptions to the GALL Report assumptions
- discussion of how the line is consistent with the corresponding AMR item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding AMR item in the GALL Report (e.g., when an exception is taken to a GALL Report AMP)

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

3.0.1.2 Overview of Table 2s

Each Table 3.x.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 (RCSs), engineered safety features (ESFs), auxiliary systems). For example, the ESF group contains tables specific to the containment spray system, residual heat removal system, and safety injection system. Each Table 2 consists of the following nine columns:

(1) Component Type—The first column lists LRA Section 2 component types subject to an AMR in alphabetical order.

(2) Intended Function—The second column identifies the license renewal intended functions, including abbreviations, where applicable, for the listed component types. Definitions and abbreviations of intended functions are in LRA Table 2.0-1.

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

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

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

(6) AMPs—The sixth column lists the AMPs that the applicant uses to manage the identified aging effects.

(7) NUREG-1801 Volume 2 Item—The seventh column lists the GALL Report item(s) identified in the LRA as similar to the AMR results. The applicant compared each combination of component type, material, environment, AERM, and AMP in LRA Table 2 with the GALL Report items. If there were no corresponding items in the GALL Report, the applicant left the column blank in order to identify the AMR results in the LRA tables corresponding to the items in the GALL Report tables.

(8) Table 1 Item—The eighth column lists the corresponding summary item number from LRA Table 1. If the applicant identifies in each LRA Table 2 AMR results consistent with the GALL Report, the Table 1 AMR item summary number should be listed in LRA Table 2. If there is no corresponding item in the GALL Report, column eight is left blank. In this manner, the information from the two tables can be correlated.

(9) Notes—The ninth column lists the corresponding notes used to identify how the information in each Table 2 aligns with the information in the GALL Report. The notes, identified by letters, were developed by an NEI work group and will be used in future LRAs. Any plant-specific notes identified by numbers provide additional information about the consistency of the AMR item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted the following three types of evaluations of the AMRs and AMPs:

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

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

(3) For other items, the staff conducted a technical review to verify conformance with 10 CFR 54.21(a)(3) requirements.

These audits and technical reviews 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 the Program—Scope of the program should include the specific SCs subject to an AMR for license renewal.

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

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

(4) Detection of Aging Effects—Detection of aging effects should occur before there is a loss of structure or component intended functions. This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new and one-time inspections to ensure timely detection of aging effects.

(5) Monitoring and Trending—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 functions are maintained under all CLB design conditions during the period of extended operation.

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

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

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

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

The staff reviewed the applicant's Quality Assurance (QA) Program and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the QA Program included an assessment of the “corrective actions,” “confirmation process,” and “administrative controls” program elements.

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

3.0.2.2 Review of AMR Results

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 7, “NUREG-1801 Volume 2 Line Item.” The staff also conducted onsite audits to verify the correlation. A blank column 7 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 USAR Supplement

Consistent with the SRP-LR, for the AMRs and associated AMPs that it reviewed, the staff also reviewed the updated safety analysis report (USAR) 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, the SRP-LR, the GALL Report, and RAI responses. 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 3.0-1 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 3.0-1. Davis-Besse Aging Management Programs

Applicant AMP	LRA sections	New or existing program	Applicant comparison to the GALL Report	GALL Report AMPs	SER section
10 CFR Part 50, Appendix J Program	A.1.1 B.2.1	Existing	Consistent	XI.S4, "10 CFR 50, Appendix J"	3.0.3.1.1
Aboveground Steel Tanks Inspection Program	A.1.2 B.2.2	Existing	Consistent with enhancement	XI.M29, "Aboveground Steel Tanks Program"	3.0.3.2.1
Air Quality Monitoring Program	A.1.3 B.2.3	Existing	Plant-specific	Not applicable	3.0.3.3.1
Bolting Integrity Program	A.1.4 B.2.4	Existing	Consistent with exceptions	XI.M18, "Bolting Integrity"	3.0.3.2.2
Boral® Monitoring Program	A.1.5 B.2.5	New	Plant-specific	Not applicable	3.0.3.3.2
Boric Acid Corrosion Program	A.1.6 B.2.6	Existing	Consistent	XI.M10, "Boric Acid Corrosion"	3.0.3.1.2
Buried Piping and Tanks Inspection Program	A.1.7 B.2.7	Existing	Consistent with enhancements	XI.M34, "Buried Piping and Tanks Inspection"	3.0.3.2.3
Closed Cooling Water Chemistry Program	A.1.8 B.2.8	Existing	Consistent with exception	XI.M21 "Closed-Cycle Cooling Water System"	3.0.3.2.4
Collection, Drainage, and Treatment Components Inspection Program	A.1.9 B.2.9	New	Plant-specific	Not applicable	3.0.3.3.3
Cranes and Hoists Inspection Program	A.1.10 B.2.10	Existing	Consistent with enhancement	XI.M23, "Inspection of Overhead Heavy Load and Light Load (Relating to Refueling) Handling Systems"	3.0.3.1.3
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection	A.1.11 B.2.11	New	Consistent	XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	3.0.3.1.4

Applicant AMP	LRA sections	New or existing program	Applicant comparison to the GALL Report	GALL Report AMPs	SER section
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program	A.1.12 B.2.12	New	Consistent	XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.5
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program	A.1.13 B.2.13	New	Consistent	XI.E2, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits”	3.0.3.1.6
Environmental Qualification (EQ) of Electrical Components Program	A.1.14 B.2.14	Existing	Consistent	X.E1, “Environmental Qualification (EQ) of Electric Components”	3.0.3.1.7
External Surfaces Monitoring Program	A.1.15 B.2.15	Existing	Consistent with enhancements	XI.M36, “External Surfaces Monitoring”	3.0.3.2.5
Fatigue Monitoring Program	A.1.16 B.2.16	Existing	Consistent with enhancements	X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary”	3.0.3.2.6
Fire Protection Program	A.1.17 B.2.17	Existing	Consistent with exceptions	XI.M26, “Fire Protection”	3.0.3.2.7
Fire Water Program	A.1.18 B.2.18	Existing	Consistent with enhancements	XI.M27, “Fire Water System”	3.0.3.2.8
Flow-Accelerated Corrosion Program	A.1.19 B.2.19	Existing	Consistent	XI.M17, “Flow-Accelerated Corrosion”	3.0.3.1.8
Fuel Oil Chemistry Program	A.1.20 B.2.20	Existing	Consistent with exceptions	XI.M30, “Fuel Oil Chemistry”	3.0.3.2.9
Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program	A.1.21 B.2.21	New	Consistent with enhancement	XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.9
Inservice Inspection (ISI) Program—IWE	A.1.22 B.2.22	Existing	Consistent with enhancement	XI.S1, “ASME Section XI Subsection IWE”	3.0.3.1.10

Applicant AMP	LRA sections	New or existing program	Applicant comparison to the GALL Report	GALL Report AMPs	SER section
Inservice Inspection (ISI) Program—IWF	A.1.23 B.2.23	Existing	Consistent	XI.S3, "ASME Section XI Subsection IWF"	3.0.3.1.11
Inservice Inspection Program	A.1.24 B.2.24	Existing	Consistent	XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	3.0.3.1.12
Leak Chase Monitoring Program	A.1.25 B.2.25	Existing	Plant-specific	Not applicable	3.0.3.3.4
Lubricating Oil Analysis Program	A.1.26 B.2.26	Existing	Consistent	XI.M39, "Lubricating Oil Analysis"	3.0.3.1.13
Masonry Wall Inspection	A.1.27 B.2.27	Existing	Consistent with enhancements	XI.S5, "Masonry Wall Program"	3.0.3.2.10
Nickel-Alloy Management Program	A.1.28 B.2.28	Existing	Plant-specific	Not applicable	3.0.3.3.5
Nickel-Alloy Reactor Vessel Closure Head Nozzles Program	A.1.29 B.2.29	Existing	Consistent	XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors"	3.0.3.1.14
One-Time Inspection Program	A.1.30 B.2.30	New	Consistent with enhancements	XI.M32, "One-Time Inspection"	3.0.3.2.11
Open-Cycle Cooling Water Program	A.1.31 B.2.31	Existing	Consistent with exception	XI.M20, "Open-Cycle Cooling Water System"	3.0.3.2.12
PWR Reactor Vessel Internals Program	A.1.32 B.2.32	New	Plant-specific	Not applicable	3.0.3.3.6
PWR Water Chemistry Program	A.1.33 B.2.33	Existing	Consistent	XI.M2, "Water Chemistry"	3.0.3.1.15
Reactor Head Closure Studs Program	A.1.34 B.2.34	Existing	Consistent with enhancement	XI.M3, "Reactor Head Closure Studs"	3.0.3.2.13
Reactor Vessel Surveillance Program	A.1.35 B.2.35	Existing	Consistent with enhancement	XI.M31, "Reactor Vessel Surveillance"	3.0.3.2.14
Selective Leaching Inspection Program	A.1.36 B.2.36	New	Consistent	XI.M33, "Selective Leaching of Materials"	3.0.3.1.16

Applicant AMP	LRA sections	New or existing program	Applicant comparison to the GALL Report	GALL Report AMPs	SER section
Small Bore Class 1 Piping Inspection Program	A.1.37 B.2.37	New	Consistent	XI.M35, "One-time inspection of ASME Code Class 1 Small-Bore Piping"	3.0.3.1.17
Steam Generator Tube Integrity Program	A.1.38 B.2.38	Existing	Consistent	XI.M19, "Steam Generator Tube Integrity"	3.0.3.1.18
Structures Monitoring Program	A.1.39 B.2.39	Existing	Consistent with enhancements	XI.S6, "Structures Monitoring Program"	3.0.3.2.15
Water Control Structures Inspection Program	A.1.40 B.2.40	Existing	Consistent with exceptions and enhancements	XI.S7, "Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants"	3.0.3.2.16
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program	A.1.41 B.2.41	New	Plant-specific	Not applicable	3.0.3.3.7
Nuclear Safety-Related Protective Coatings Program	A.1.42 B.2.42	Existing	Plant-specific	Not applicable	3.0.3.3.8
Shield Building Monitoring Program	A.1.43 B.2.43	New	Plant-specific	Not applicable	3.0.3.3.9

3.0.3.1 AMPs Consistent with the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as consistent with the GALL Report:

- 10 CFR Part 50, Appendix J Program
- Boric Acid Corrosion Program
- Cranes and Hoists Inspection Program
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program
- Environmental Qualification (EQ) of Electrical Components Program
- Flow-Accelerated Corrosion Program

- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program
- Inservice Inspection (ISI) Program—IWE
- Inservice Inspection (ISI) Program—IWF
- Inservice Inspection Program
- Lubricating Oil Analysis Program
- Nickel-Alloy Reactor Vessel (RV) Closure Head Nozzles Program
- Pressurized-Water Reactor (PWR) Water Chemistry Program
- Selective Leaching Inspection Program
- Small Bore Class 1 Piping Inspection Program
- Steam Generator Tube Integrity Program

3.0.3.1.1 10 CFR Part 50, Appendix J Program

Summary of Technical Information in the Application. LRA Section B.2.1 describes the existing 10 CFR Part 50, Appendix J Program as consistent with GALL Report AMP XI.S4, "10 CFR Part 50, Appendix J." The LRA states that the containment leak rate tests are performed in accordance with guidelines contained in NRC RG 1.163 "Performance-Based Containment Leak-Test Program," and NEI 94-01 "Industry Guidance for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J." The applicant uses the performance-based approach of Option B to 10 CFR Part 50, Appendix J to implement the requirements of containment leak-rate testing frequency. The applicant also stated that the containment leak rate tests are performed to assure that the leakage through the primary containment and systems and components penetrating primary containment will not exceed allowable values specified in technical specifications (TS). The applicant further stated that the periodic surveillance of primary containment penetrations and isolation valves is performed so that proper maintenance and repairs are made.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff performed a review to compare elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.S4.

During the audit, the staff noted that Subsection 2.1.2 of the Davis-Besse Surveillance Test Procedures, DB-PF-03009, Revision 06, "Containment Vessel and Shielding Building Visual Inspection" states that "[p]ersonnel who performed the examination of the exterior surface of the Containment Vessel and the shield building need not be qualified in accordance with NOP-CC-5708." The staff could not determine the procedure used by the applicant to qualify personnel to perform visual examinations of the containment vessel and shielding building. The staff further noted that LRA Section B.2.22, "Inservice Inspection (ISI) Program—IWE," established that the Inservice Inspection (ISI) Program—IWE will support examination and testing of accessible surface areas of the steel containment vessel; containment hatches and airlocks; seals, gaskets and moisture barriers; and containment pressure-retaining bolting. The staff also noted that these examinations are in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, 1995 Edition through the

1996 Addenda. The staff observed that the “detection of aging effects” program element in GALL Report AMP XI.S4 recommends implementation of an acceptable containment Inservice Inspection Program, as described in ASME Section XI, Subsection IWE (AMP XI.S1). Subsection IWE-3510.1 of ASME Code Section XI (1995) requires that “the general visual examination shall be performed by, or under the direction of, a registered Professional Engineer or other individual, knowledgeable in the requirements for design, inservice inspections, and testing of Class MC and metallic liners of Class CC components.”

By letter dated April 5, 2011, the staff issued RAI B.2.1-1 requesting the applicant to clarify the qualifications of the personnel performing the visual examinations of the exterior surface of steel containment and both sides of the shield building to be consistent with the recommendations in Element 4, “detection of aging effects.”

In its response dated May 5, 2011, the applicant stated that Subsection 2.1.1 of the surveillance test procedure DB-PF-03009, Revision 6 “Containment Vessel and Shielding Building Visual Inspection” shall be enhanced, prior to the period of extended operation, to state the following:

> Personnel who perform general visual examinations of the exterior surface of the Containment Vessel and the interior and exterior surfaces of the Shield Building shall meet the requirements for a general visual examiner in accordance with Nuclear Operating Procedure NOP-CC-5708, “Written Practice for the Qualification and Certification of Nondestructive Examination Personnel.” These individuals shall be knowledgeable of the types of conditions which may be expected to be identified during the examinations.

The applicant associated its response with a new commitment (Commitment No. 27).

The staff reviewed the applicants response to RAI B.2.1-1 and noted that the applicant—per 10 CFR Part 50 Appendix J, RG 1.163, NEI 94-01, Revision 0, and American National Standards Institute (ANSI)/American Nuclear Society (ANS)-56.8-1994—must perform a general visual inspection of the accessible interior and exterior surfaces of the primary containment, components, and penetrations prior to the pressurization and at a periodic interval between tests to assure the containment leak-tight integrity. The staff confirmed during its audit that the applicant uses the 1995 ASME Code Section XI-Division I, which, as stated above in IWE-3501.1, has specific requirements for individuals performing the inspections. It was not clear to the staff to what extent the applicant’s surveillance and testing procedures, DB-PF-03009, Revision 6 and NOP-CC-5708 referenced the IWE-3510.1 requirements

By letter dated June 20, 2011, the staff issued RAI B.2.1-2 stating that to ensure the qualification of personnel performing visual inspections at Davis-Besse meet the current plant code requirements, Subsection IWE-3510.1 of ASME Code Section XI (1995) must be referenced in the new revision of the Davis-Besse surveillance test procedure.

In its response dated August 26, 2011, the applicant stated that although FENOC is the owner of several nuclear operating power station sites with fleet procedures applicable to all (e.g., NOP-CC-5708), the ASME Code Editions are different for each station (e.g., the 1995 Edition through the 1996 Addenda of ASME Code Section XI is currently used in the third 10-year ISI interval at Davis-Besse). The applicant further stated that it revised the fleet procedure to incorporate the requirement of Subsection IWE-3510.1 of the ASME Code Section XI (1995) verbatim in Section 4.2.5, “General Visual Examiner (IWE / IWL),” of NOP-CC-5708, Revision 03. The applicant also revised the Davis-Besse plant procedure Section 2.1.2 of the

DB-PF-03009, Revision 07, "Containment Vessel and Shield Building Visual Inspections," which refers to the fleet procedure for the qualification of personnel performing visual inspections.

In a conference call held November 22, 2011, the staff requested that the applicant provide the revised plant and fleet procedures that incorporate the requirements of Subsection IWE-3510.1 of the ASME Code Section XI (1995). By letter dated December 7, 2011, the applicant provided the relevant sections of the revised plant and fleet procedures. The staff reviewed the procedures and determined that the requirement of Article IWE-3510.1 of the ASME Code (1995) is met by incorporating the current code condition requiring qualification of personnel performing visual inspections into the fleet procedure. The staff's concerns described in RAIs B.2.1-1 and B.2.1-2 are resolved.

Based on the audit, and review of the applicant's response to RAIs B.2.1-1 and B.2.1-2, the staff finds that elements one through six of the applicant's 10 CFR Part 50, Appendix J Program are consistent with the corresponding program elements of GALL Report AMP XI.S4 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.1 summarizes operating experience related to the 10 CFR Part 50, Appendix J Program.

The applicant established the maximum allowable containment leakage rates, L_a, at P_a (38 pounds per square inch gauge (psig)) as 0.75 L_a (0.375 weight-percent per day) for Type A test and 0.60 L_a (0.300 weight-percent per day) for Type B and C tests. During the audit, the applicant provided the staff with the most recent Containment Leak Rate Testing Program, Revision 7, document. The last two Type A, integrated leak rate tests (ILRT) results were 0.0127 weight-percent per day and 0.1671 weight-percent per day performed on May 5, 2000 (12 refueling outage (RFO)), and April 8, 2003 (13 RFO), respectively. The measured leak rates are well below the acceptance criteria of 0.75 L_a (0.375 weight-percent per day). It was demonstrated that the two consecutive periodic Type A tests had acceptable performance history. Therefore, Type A test frequency was extended to at least once per 10 years per the optional performance-based requirements of Option B to 10 CFR Part 50, Appendix J. The applicant stated that no Type A tests have failed to meet their acceptance criteria at Davis-Besse. The results of the last four Type A test results are tabulated in Table 3.0-2.

Table 3.0-2. Type A Test Results

Outage	Date	Test (wt%/day)	0.75L_a (wt%/day)	Procedure
5 RFO	Sept. 1988	0.0525	0.375	DB-PF03009
7 RFO	Oct. 1991	0.0622	0.375	DB-PF10309
12 RFO	May 2000	0.0127	0.375	DB-PF10310
13 RFO	Apr. 2003	0.1671	0.375	DB-PF10310

The staff reviewed the applicant's Type A test results. Table 3.0-2 above shows that the Type A test result for the 13 RFO was equal to 0.1671 (wt%/day) while the result for the 12 RFO Type A test was eual to .0127 (wt%/day). Therefore the staff noted that the Type A test result for the 13 RFO is 13.16 (0.1671/0.0127) times larger than the Type A test result in 12 RFO. However, all Type A test results are within the allowable containment leakage rate limit of 0.375 weight-percent per day. Furthermore, during the review and discussions with the applicant, the staff found no indication that Davis-Besse's 10 CFR Part 50, Appendix J Program would not be effective in adequately managing aging effects during the period of extended operations.

The applicant stated that an electrical penetration and isolation valve exceeded the leakage criteria during the Type B and Type C during the 15 RFO, but both were returned to within their individual limits after performing the corrective actions.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.1 provides the USAR supplement for the 10 CFR Part 50, Appendix J Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.5-2.

The staff also notes that the applicant committed (Commitment No. 27) to enhance its surveillance test procedures to ensure the qualification requirements for examiners are clear for Davis-Besse. As stated above, NOP-CC-5708, Section 2.4.5, Revision 3, "Written Practice for the Qualification and Certification of Nondestructive Examination Personnel," provides the ASME Code requirement for the general visual Examiner (IWE/IWL) for Davis-Besse. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's 10 CFR Part 50, Appendix J Program, the staff finds all program elements consistent with the GALL Report. The staff concludes, that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Boric Acid Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.6 describes the existing Boric Acid Corrosion Program as consistent with GALL Report AMP XI.M10, "Boric Acid Corrosion." The applicant stated that its Boric Acid Corrosion Program manages the effects of boric acid leakage on the external surfaces of SCs potentially exposed to boric acid leakage. The applicant also stated that the program includes visual inspections to provide for management of loss of material due to boric acid corrosion. The applicant further stated that the program relies in part on implementation of recommendations of NRC Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." The applicant stated that the program ensures that the pressure boundary integrity and material condition of the subject SCs are maintained consistent with the CLB during the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M10. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.M10. Based on its audit, the staff finds that elements one through six of the applicant's Boric Acid Corrosion Program are consistent with the corresponding program elements of GALL Report AMP XI.M10 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.6 summarizes operating experience related to the applicant's Boric Acid Corrosion Program.

The applicant's operating experience provided details on engineering analyses and corrective actions taken in response to detected leakage of boric acid. In the most significant instance of operating experience, which is documented in Licensee Event Report (LER) 2002-02, the applicant stated that extensive degradation of the original Davis-Besse RV closure head occurred as a result borated water leakage from a crack in a control rod drive (CRD) mechanism nozzle head penetration. The applicant also stated that past performance deficiencies in the Boric Acid Corrosion Program led to a sustained period over which boric acid leakage was undetected, resulting in the head degradation.

The applicant stated that, since the instance of head degradation, program compliance reviews were performed to ensure proper interface with supporting plant programs, proper consideration of industry experience, proper staffing, and timely resolution of identified weaknesses. The applicant also stated that a 2008 self-assessment identified improvements in the Boric Acid Corrosion Program that included identifying acceptance criteria for pump seal leakage, ensuring that conclusion statements in the Corrective Action Program have sufficient level of detail, and monitoring the effectiveness of corrective actions for packing adjustments. The applicant further stated that a 2008 review by the staff of the applicant's boric acid control activities against commitments made in response to GL 88-05 concluded that no findings of significance were identified.

The staff reviewed operating experience information, in the application and during the audit, to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation. The staff also found that the applicant appropriately considered operating experience, such as that related to the vessel head degradation, when making improvements to its Boric Acid Corrosion Program.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.6 provides the USAR supplement for the Boric Acid Corrosion Program. The staff reviewed this USAR supplement description of the program against the recommended description for this type of program, as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, 3.4-2, 3.5-2, and 3.6-2 and found that it does not include activities associated with discovered evidence of boric acid leakage. The example description for this program in the SRP-LR Tables includes determination of the principal location of leakage, removal of boric acid residues, and engineering evaluations to establish the impact on the reactor coolant pressure boundary (RCPB). The licensing basis for the period of extended operation may not be adequate if the applicant does not incorporate this information in its USAR supplement. By letter dated June 20, 2011, the staff issued RAI A.1.6-1 requesting that the applicant revise the USAR supplement to include the above activities associated with discovered evidence of boric acid leakage. In its response dated July 22, 2011, the applicant revised the USAR supplement, Section A.1.6, and the LRA AMP, Section B.2.6, to state that the Boric Acid Corrosion Program includes the following:

- visual inspection of external surfaces that are potentially exposed to borated water leakage
- timely discovery of leak path and removal of the boric acid residues
- assessment of the damage
- followup inspection for adequacy

The staff finds the applicant's response acceptable because the program description in the USAR supplement includes sufficient information to describe activities after boric acid leakage is discovered such that the basis for aging management is clearly stated.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Boric Acid Corrosion Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Cranes and Hoists Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.10 describes the existing Cranes and Hoists Inspection Program as consistent with GALL Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems." The applicant stated that this program is credited with managing loss of material for the structural components of cranes (e.g., bridge, trolley, rails, and girders), monorails, and hoists within the scope of license renewal. The applicant also stated that this program is a condition monitoring program that is based on guidance contained in ANSI B30.2 for overhead and gantry cranes, ANSI B30.11 for monorail systems and underhung cranes, and ANSI B30.16 for overhead hoists. This program implements periodic inspections to monitor for signs of corrosion and wear.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M23. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M23, with the exception of the "scope of program" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

GALL Report AMP XI.M23 states this program manages the effect of loss of preload of bolted connections. However, during its audit, the staff found the applicant's Cranes and Hoist Inspection Program did not identify loss of preload in the program description or as an aging effect in corresponding AMR items.

By letter dated April 20, 2011, the staff issued RAI B.2.10-02 requesting that the applicant provide clarification regarding the use of this program to manage the loss of preload aging effect for bolted connections of cranes and hoists.

In its response dated May 24, 2011, the applicant stated that the Cranes and Hoists Inspection Program will be enhanced prior to entering the period of extended operation to include loss of preload for bolted connections of cranes and hoists by implementing visual inspections for loose bolts and missing or loose nuts in crane, monorail, and hoist inspection procedures at the same frequency as inspections of rails and structural components. The applicant also revised LRA Tables 2.4-13, 3.3.1, and 3.5.2-13 to include the loss of preload aging effect. The staff finds the applicant's response acceptable for the following reasons:

- The Cranes and Hoists Inspection Program includes periodic visual inspections that are capable of detecting loss of preload in the form of loose bolts and nuts in cranes, monorails, and hoists.
- Periodic inspections provide ongoing opportunities to detect the aging effect if it should occur.
- Proper material selection, lubrication, installation, and adherence to plant procedures and vendor instructions during assembly of bolted joints minimizes the possibility for a loss of preload.
- The program includes requirements for implementing corrective actions if unacceptable indications of loss of preload are found.

Based on its audit and review of the applicant's response to RAI B.2.10-02, the staff finds that elements one through six of the applicant's Cranes and Hoists Inspection Program are consistent with the corresponding program elements of GALL Report AMP XI.M23 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.10 summarizes operating experience related to the Cranes and Hoists Inspection Program. The applicant stated it identified age-related degradation while performing intake gantry crane preventive maintenance in 2009. The applicant stated this crane is exposed to weather and is the only crane managed by this AMP in this environment. The applicant's Corrective Action Program documented the corrosion-related degradation around the bridge drive gear and included the bolts in this area. The applicant also stated that related crane and hoist inspections have found isolated minor age-related degradation such as corrosion and paint chipping due to mechanical damage. The applicant stated the Corrective Action Program documented and corrected these issues before any loss of function was experienced.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

In addition, the staff confirmed that the applicant addressed operating experience identified after issuance of the GALL Report. The applicant reviewed completed work orders from 2005–2008 to address operating experience documented in the Corrective Action Program. The discovery of minor flaking paint and loss of material due to corrosion documented in the program resulted in the addition of an inspection step specifically looking for wear products on the rails, bridge wheels, and trolley wheels for fuel handling and spent fuel pool (SFP) cask cranes.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.10 provides the USAR supplement for the Cranes and Hoists Inspection Program.

The staff reviewed this USAR supplement description of the program against the recommended description for this type of program, as described in SRP-LR Table 3.3-2.

The staff reviewed the applicant's USAR supplement and found that it does not indicate that the program addresses a review of the number and magnitude of lifts made by a hoist or crane. The example description for this program in SRP-LR Table 3.3-2 includes specific mention of these guidelines. The licensing basis for the period of extended operation may not be adequate if the applicant does not incorporate this information in its USAR supplement.

By letter dated April 20, 2011, the staff issued RAI B.2.10-01 requesting that the applicant clarify why it did not include the referenced guideline in SRP-LR Table 3.3-2.

In its response dated May 24, 2011, the applicant revised the USAR supplement in LRA Section A.1.10. The amended USAR supplement states that the Cranes and Hoists Inspection Program includes a review of the number and magnitude of lifts made by a crane, monorail, or hoist.

With this amendment, the staff finds the USAR supplement for the Cranes and Hoists Inspection Program acceptable because it is consistent with the corresponding program description in SRP-LR Table 3.3-2. The staff's concern described in RAI B.2.10-01 is resolved. The staff also notes that the applicant committed (Commitment No. 29) to enhance the Cranes and Hoists Inspection Program prior to entering the period of extended operation. Specifically, the applicant committed to include visual inspections for loose bolts and missing or loose nuts in crane, monorail, and hoist inspection procedures at the same frequency as inspections of rails and structural components.

The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Cranes and Hoists Inspection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 29 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection

Summary of Technical Information in the Application. LRA Section B.2.11 describes the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection as consistent with GALL Report AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," as modified by License Renewal Interim Staff Guidance (LR-ISG)-2007-02. The applicant stated that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection will focus primarily on bolted connections. This aging management inspection will account for aging stressors such as thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation of the metallic parts. The applicant also stated that the inspection will be performed via the use of thermography, with the optional use of contact resistance testing as a supplement. The applicant further stated that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection is a one-time inspection that will be conducted prior to the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.E6. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.E6, with the exception of the "parameters monitored or inspected" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

In the "parameters monitored or inspected" program element of basis document LRPD-05, "Aging Management Evaluation Results," the applicant states that the technical basis for the sample selected will be documented. In the same element of GALL Report AMP XI.E6, Revision 2, it states that the applicant will document the technical basis for the sample selected. It was not clear to the staff that these statements are consistent because the applicant has not developed the technical basis or the criteria for sample selection. By letter dated April 5, 2011, the staff issued RAI B.2.11-1 requesting the applicant to provide a technical basis for the sample selection. In its response dated May 5, 2011, the applicant stated the following:

> "[The] parameters monitored or inspected" and "detection of aging effects" program elements of LRA Section B.2.11, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection," are revised to state that 20 percent of the electrical cable connection population, with a maximum of 25 connections, constitutes a representative sample size. This sample size is based on that provided in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 2, Section XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The staff finds the applicant's response acceptable because the applicant provided the sample size for the one-time inspection, and this sample size is consistent with those in GALL Report, Revision 2, Section XI.E6. The staff's concern described in RAI B.2.11-1 is resolved.

In the program basis document LRPD-05, under the "parameters monitored or inspected" program element, the applicant states that the inspections will include detection of loosened bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. It further states, in part, that the connection type (i.e., bolted splices, bolted terminations, lug terminations, bolted cable terminations) will be considered for sampling. The connections associated with cables within the scope of license renewal are splices (butt or bolted), crimp-type ring lugs, connectors, and terminal blocks, as described in the program description in GALL Report AMP XI.E6, Revision 2. The staff believes that loosening of cable connections may also occur in different types of connections and may not only be limited to bolted connections. By letter dated April 5, 2011, the staff issued RAI B.2.11-3 requesting the applicant to provide technical justification of why only bolted connections are considered in the inspection sample criteria. In its response dated May 5, 2011, the applicant revised LRA Sections A.1.11 and B.2.11 to include various connection types. The staff reviewed the LRA amendments and finds them acceptable because the LRA Section B.2.11 now includes various connection types, and these connection types are consistent with those in the GALL Report Revision 2, Section XI.E6. The staff's concern described in RAI B.2.11-3 is resolved.

During a plant walkdown, the staff noted cable bus connections in a terminal housing connecting cable bus, bus tie transformers, and the 4,160 volt (V) essential switchgear buses. The applicant indicated to the staff that these cable buses were not subject to an AMP because they are not located in an adverse localized environment. The staff agreed with the applicant that insulation material for cable buses are not subject to an AMP because they are not in an adverse localized environment due to high heat or high radiation. However, metallic material of cable bus connections may experience increased resistance of connection due to loosening of bolted connections caused by repeated thermal cycling of connected loads.

By letter dated April 5, 2011, the staff issued RAI B.2.11-4 requesting the applicant to explain how the cable bus connections will be managed during the period of extended operation. In its response dated May 5, 2011, the applicant revised LRA Sections A.1.11 and B.2.11 to include various connection types. The applicant also stated that "the metallic material of cable bus connections is managed by the Davis-Besse B.2.11 AMP." The staff finds the applicant response acceptable because the applicant revised LRA Sections A.1.11 and B.2.11 to inspect various connection types including cable bus connections. The staff's concern described in RAI B.2.11-4 is resolved.

Based on its audit, and review of the applicant's responses to RAIs B.2.11-1, B.2.11-3, and B.2.11-4, and LRA Section B.2.11 and LRPD-05, the staff finds that elements one through six of the applicant's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection are consistent with the corresponding program elements of GALL Report AMP XI.E6, Revision 2 (LR-ISG-2007-02 incorporated) and, therefore, are acceptable.

Operating Experience. LRA Section B.2.11 summarizes operating experience related to the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection. The applicant stated that plant operating experience has shown that the Corrective Action Program has addressed issues related to degraded cable connections (primarily terminations) in recent years. The applicant stated that the use of routine thermography has identified terminations at circuit breakers with elevated temperatures, typically caused by increased resistance at phase terminations. The applicant also stated that a hot spot was found on a disconnect switch in the plant switchyard, due to a misaligned phase arm on the switch. The applicant further stated that terminations in a motor control center have been identified with higher temperatures (via thermography), indicating increased resistance at the termination points. The applicant stated that the use of thermography has been effective in identifying degraded cable connections. The applicant also stated that industry operating experience will be considered in development of this activity.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in accordance with the GALL Report. As discussed in the audit report, the staff conducted walkdowns, interviewed the applicant's staff, and reviewed onsite documentation provided by the applicant. The staff also conducted an independent search of the applicant's operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. Further, the staff performed a search of regulatory operating experience for at least the past 10-year period through November 2010. Databases were searched using various key word searches and then reviewed by technical auditor staff.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.11 provides the USAR supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection.

The staff reviewed this USAR supplement description of the program and notes that it does not conform to the recommended description for this type of program, as described in SRP-LR, Revision 2, Table 3.0-1. The staff reviewed the USAR A.1.11 supplement description for the program, which states that the one-time inspection uses thermography (augmented by the optional use of contact resistance testing) to detect loose or degraded connections. The staff noted that a one-time inspection is to provide additional confirmation to support industry operating experience that shows electrical cable connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective. The example description for this program is described in SRP-LR, Revision 2,Table 3.0-1. The one-time inspection is to confirm that either aging of cable connections is not occurring or that existing preventive maintenance program is effective such that a periodic inspection program is not required, or both. By letter dated April 5, 2011, the staff issued RAI B.2.11-2 requesting the applicant to provide an adequate program description consistent with the description provided in SRP-LR Revision 2, Table 3.0-1. In its response dated May 5, 2011, the applicant stated that LRA Section A.1.11, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection,” is revised to provide an adequate program description based on the description provided in SRP-LR, Revision 2, Table 3.0-1. The staff finds the applicant’s response acceptable because it revised LRA Section A.1.11 to provide an adequate program description, and the program description is consistent with that in Table 3.0-1 of SRP-LR, Revision 2. The staff’s concern described in RAI B.2.11-2 is resolved.

The staff also noted that the applicant committed (Commitment No. 5) to implement the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection prior to entering the period of extended operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its audit and review of the applicant’s Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection, and the applicant’s responses to the staff RAIs B.2.11-1, B.2.11-3, and B.2.11-4, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and the applicant’s response to RAI B.2.11-2 and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

<u>Summary of Technical Information in the Application</u>. LRA Section B.2.12 describes the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL Report AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” The applicant stated that the program provides for the periodic visual inspection of accessible, non-environmentally qualified electrical cables and connections to determine if age-related degradation is occurring. The applicant also stated that accessible electrical cables and connections installed in adverse localized 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, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.E1. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.E1. Based on its audit, the staff finds that elements one through six of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program are consistent with the corresponding program elements of GALL Report AMP XI.E1 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.12 summarizes operating experience related to the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program.

The staff identified operating experience as stated in the audit report that indicated wires were found damaged by heat during solenoid replacement. The staff also noted that in a similar condition report (CR), degraded cable insulation was identified by the applicant during maintenance testing for the No. 1 turbine plant cooling water motor refurbishment. The staff confirmed that the applicant took corrective action to address the cable insulation degradation issue.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. Further, the staff performed a search of regulatory operating experience for at least the past 10-year period through November 2010. Databases were searched using various key word searches and then reviewed by technical auditor staff.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.12 provides the USAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR, Revision 2, Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 6) to implement the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program

Summary of Technical Information in the Application. LRA Section B.2.13 describes the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program as consistent with GALL Report 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 the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will manage the aging of the low current instrumentation cables and connections used in neutron monitoring and radiation monitoring circuits with sensitive, low current signals. The applicant also stated that this program applies to in-scope, non-environmentally qualified electrical cables and connections used in neutron monitoring and radiation monitoring circuits with sensitive, low current signals.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.E2. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.E2. Based on its audit, the staff finds that elements one through six of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program are consistent with the corresponding program elements of GALL Report AMP XI.E2; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.13 summarizes operating experience related to the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program.

The applicant stated in the LRA that plant operating experience has shown that the Corrective Action Program has addressed issues of neutron detector and connection degradation in recent years. The applicant also stated that, in 2005, the radiation detector associated with a cable for component cooling water (CCW) system was found to be degraded due to aging. The applicant further stated that, in 2009, an intermittent connection failure was noted for the connection between the detector and the pre-amplifier. The staff confirmed that corrective actions were taken.

The staff reviewed operating experience information, in the application and other documentation during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed and evaluated by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. Further, the staff performed a search of regulatory operating experience for at least the past 10-year period through November 2010. Databases were searched using various key word searches and then reviewed by technical auditor staff.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.13 provides the USAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR, Revision 2, Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 7) to implement the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Environmental Qualification (EQ) of Electrical Components Program

Summary of Technical Information in the Application. LRA Section B.2.14 describes the existing Environmental Qualification (EQ) of Electrical Components Program as consistent with GALL Report AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The applicant stated that the Environmental Qualification (EQ) of Electrical Components Program manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations. The applicant also stated that the program requires action to be taken before individual components in the scope of the program exceed their qualified life. The applicant further stated that actions taken include replacement on a specified time interval of either piece parts or complete components to maintain qualification and reanalysis.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The applicant stated in the LRA application that actual plant temperature data will be obtained from monitors used for compliance with TS, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). The applicant also stated that plant temperature data may be used in an aging evaluation in different ways, such as direct input into the evaluation or as a demonstration of conservatism when using plant design temperature for an evaluation.

In component aging evaluation, the applicant stated that, when unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. The applicant also stated that the reanalysis is to be performed in a timely manner where sufficient time is available to refurbish, replace, or re-qualify the component if the reanalysis is unsuccessful.

GALL Report AMP X.E1 states that reducing excess conservatism in the component service conditions used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for TS compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while motors are not running). GALL Report AMP X.E1 also states that plant temperature data may be used in an aging evaluation in different ways, such as directly applying the plant temperature data in the evaluation or using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis are justified on a plant-specific basis.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP X.E1. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP X.E1. Based on its audit, the staff finds that elements one through six of the applicant's Environmental Qualification (EQ) of Electrical Components Program are consistent with the corresponding program elements of GALL Report AMP X.E1 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.14 summarizes operating experience related to the EQ of Electrical Components Program. The applicant stated its program includes consideration of operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of inservice aging.

The staff reviewed the applicant's document, "Snapshot Assessment Plan EQ Program," and noted that the assessment report identified three strengths and five recommendations. Among the strengths are the applicant's plant maintenance in temperature monitoring and its trending of non-EQ functional locations that could represent a precursor to relate EQ-related issues. One of the recommendations asked the applicant to consider sending representation to Nuclear Utility Group on EQ meetings to share industry operating experiences and the use of Westinghouse lifetime temperature monitors to trend temperature throughout the plant to validate environmental conditions defined in EQ documentation.

The staff reviewed Self-Assessment No. 2001-0097, as discussed in the audit report. One of the assessment's recommendations was to develop detailed proceduralized guidance or course objectives that dictate the requirements for EQ training. The applicant's assessment of EQ health report (2009-Q1 to 2010-Q4) indicated its EQ Program consistently scored either green, which equates to the highest performance, or white, which is the second highest performance rating.

The staff reviewed the operating experience, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed and evaluated by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. Further, the staff performed a search of regulatory operating experience for at least the past 10-year period through November 2010. Databases were searched using various key word searches and then reviewed by technical auditor staff.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.14 provides the USAR supplement for the EQ of Electrical Components Program. The staff reviewed this USAR supplement description of the program and noted that, in conjunction with LRA Section 4.4 and USAR supplement Section A.2.4, it conforms to the recommended description for this type of program, as described in SRP-LR Tables 4.4-1 and 4.4-2.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's EQ of Electrical Components Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.19 describes the existing Flow-Accelerated Corrosion Program as consistent with GALL Report AMP XI.M17, "Flow-Accelerated Corrosion." The applicant stated that the Flow-Accelerated Corrosion Program manages loss of material for steel piping and other components that are susceptible to flow-accelerated corrosion. The applicant also stated that the program implements the recommendations of NRC GL 89-08 and follows the guidance and recommendations of Electric Power Research Institute (EPRI) NSAC-202L-R3 to ensure that the integrity of piping systems susceptible to flow-accelerated corrosion is maintained. The applicant further stated that the program includes predictive analysis, baseline inspections to determine the extent of thinning, and followup inspections to confirm predictions or initiate repair or replacement of components as necessary.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M17. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.M17. Based on its audit, the staff finds that elements one through six of the applicant's Flow-Accelerated Corrosion Program are consistent with the corresponding program elements of GALL Report AMP XI.M17 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.19 summarizes operating experience related to the Flow-Accelerated Corrosion Program. The applicant stated that, in 2006, a steam leak was discovered on the first stage reheat drain for moisture separator reheater No. 1, which should have been predicted by the Flow-Accelerated Corrosion Program. As a result, the applicant stated it enhanced the program by providing a second level of verification of the data entered into the predictive software, CHECWORKS®, to improve the quality of the model. The applicant's operating experience also discussed the results of inspections and evaluations documented in the flow-accelerated corrosion outage report for the cycle 15 RFO in 2008. The applicant stated that inspections at 95 locations were conducted, and no significant issues were noted. The applicant also stated that, as scheduled during the 2008 RFO, segments of 8-in. piping in the reheat drain system and 18-in. feedwater piping were replaced with 2.25 percent chrome piping to resolve flow-accelerated corrosion issues.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.19 provides the USAR supplement for the Flow-Accelerated Corrosion Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Tables 3.1-2, 3.2-2, and 3.4-2. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Flow-Accelerated Corrosion Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.21 describes the new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program as consistent with GALL Report AMP XI.E3, "Inaccessible Medium-Voltage cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that the new program will manage the aging of non-environmentally qualified inaccessible medium-voltage electrical cables susceptible to the aging effects caused by moisture and voltage stress, such that there is a reasonable assurance that the cables will perform their intended function in accordance with the CLB during the period of extended operation. The applicant also stated that inaccessible medium-voltage cables will be tested to provide an indication of the condition of the conductor insulation. The applicant further stated that the specific type of test to be performed will be determined prior to the initial test and is to be a proven test for detecting deterioration of the insulation system due to wetting. The applicant further stated that testing will be conducted at least once every 10 years, with the initial test to be completed prior to the period of extended operation.

In addition, the applicant stated that manholes associated with inaccessible non-EQ medium-voltage cables will be inspected for water accumulation and the water removed as necessary with inspections conducted at least every 2 years. The first inspection is to be completed prior to the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.E3. As discussed in the audit report, the staff found that each element of the applicant's program lacked sufficient information to determine its consistency with the corresponding elements of GALL Report AMP XI.E3. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

Industry operating experience referenced in the GALL Report indicates that the presence of water or moisture can be a contributing factor in inaccessible power cable failures at lower service voltages (400 V to 2 kilovolts (kV)). Applicable operating experience was identified in applicant responses to GL 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cable operating at service voltages of less than 2 kV where water was considered a contributing factor. The GALL Report noted that the significant voltage screening criterion (defined as being subjected to system voltage more than 25 percent of the time) was not applicable for all the inaccessible power cable failures noted.

Industry operating experience provided by NRC applicants in response to GL 2007-01 has shown that there is an increasing trend of cable failures with length in service and that the presence of water and moisture or submerged conditions appears to be the predominant factor contributing to cable failure. The GALL Report recommends the annual inspection of manholes and a cable test frequency of at least once every 6 years (with evaluation of inspection results to determine the need for an increased inspection frequency). The use of test and inspection frequencies in the determination of the need for adjustment of test and inspection frequencies is also referenced in the GALL Report.

In addition, industry operating experience in the GALL Report has shown that some applicants may experience cable manhole water intrusion events, such as flooding or heavy rain, that subjects cables within the scope of program for GALL Report AMP XI.E3 to significant moisture. The GALL Report, therefore, includes event-driven inspections of cable manholes in addition to a 1-year periodic inspection frequency.

Based on the information above, the applicant's AMP may not be consistent with GALL Report AMP XI.E3 or SRP-LR Section A.1.2.3.10 in that, as additional operating experience is obtained and lessons learned are evaluated, the program is adjusted as needed. Therefore, additional information is required by the staff to verify that the applicant's Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program elements, "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria," are consistent with the GALL Report and the USAR summary description, and applicable license renewal commitments (Commitment No. 11) are consistent with the SRP-LR, Revision 2, Table 3.0-1

By letter dated April 5, 2011, the staff issued RAI B.2.21-1 requesting the applicant to do the following:

- Provide a summary of the applicant's evaluation of recently identified industry operating experience and any plant-specific operating experience concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 EQ requirements) and explain how this operating experience applies to the need for additional aging management activities at the applicant's plant for such cables.
- Explain how Davis-Besse will manage the effects of aging on inaccessible low voltage power cables within the scope of license renewal and subject to an AMR; with consideration of recently identified industry operating experience and any plant-specific operating experience. The discussion should include an assessment of the AMP description, program elements (i.e., "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria"), USAR summary description, and applicable license

renewal commitment to demonstrate reasonable assurance that the intended functions of inaccessible low voltage power cables subject to adverse localized environments will remain consistent with the CLB through the period of extended operation.

- Provide an evaluation showing how the Non-EQ Inaccessible Medium-Voltage Cable Program test and inspection frequencies, including event-driven inspections incorporate recent industry and plant-specific operating experience for both inaccessible low and medium voltage cable. Explain how the Inaccessible Medium-Voltage Cable Program will ensure that future industry and plant-specific operating experience will be incorporated into the program such that inspection and test frequencies may be increased based on test and inspection results.

In its response dated May 5, 2011, the applicant stated the following:

> Based on industry cable operating experience and plant-specific manhole water operating experience, FENOC has determined that the addition of cables operated at or above 400 volts is prudent, and that testing of the cables within the scope of this program every six years is reasonable and allows for trending of test data. Inspection for water in the in-scope manholes at least every year, and after events that could cause water to accumulate to the level of the installed cables or conduit, is warranted. The "scope" and "testing and inspection frequency" changes will provide reasonable assurance that the cables covered by this program will continue to perform their required functions during the period of extended operation.

The applicant also stated that with applicable program elements revised to address electrical power cables at lower service voltages (400 volts alternating current (VAC) to 2 kV) the subject program is renamed as the "Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program."

In its response the applicant revised LRA Section B.2.21 to include the following enhancements:

- The significant voltage exposure definition (medium voltage cable 2 kV to 35 kV subjected to system voltage for more than 25 percent of the time) is removed as a scope of program criterion.
- The "Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program" is expanded to include 400 V to 2 kV in-scope inaccessible low voltage power cables.
- The performance of manhole inspections is increased to at least once per year.
- The testing of inaccessible cables (400 V to 35 kV) for degradation of cable insulation will be performed at least every 6 years.
- Event-driven inspections (e.g., heavy rain or flood) are incorporated into the "Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program."
- Cable test frequency will be updated as required based on test results.
- The frequency of manhole inspections for accumulated water will be established and adjusted based on plant-specific inspection results.

With the information provided by the applicant's response, the staff finds the Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program acceptable with respect to inaccessible low voltage power cables because the applicant included in-scope inaccessible low voltage power cables (400 V to 2 kV) into this program, consistent with industry and plant-specific operating experience, GALL Report AMP XIE3, and SRP-LR Section A.1.2.3.10 such that there is reasonable assurance that inaccessible low voltage power cables subject to significant moisture will be adequately managed during the period of extended operation. The applicant also revised cable testing frequencies to at least every 6 years and manhole inspections to at least once per year. Manhole inspections will also be performed in response to event-driven occurrences such as heavy rain or flooding. The applicant's incorporation of increased testing, inspection frequencies and event-driven inspections into the Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program is acceptable because the changes are also consistent with industry operating experience, GALL Report AMP XI.E3, and SRP-LR Section A.1.2.3.10. The elimination of the significant voltage definition (subjected to system voltage for more than 25 percent of the time) is also acceptable because this change expands the scope of the program, consistent with industry inaccessible medium voltage cable operating experience and GALL Report AMP XI.E3. The applicant also revised the Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program to provide more frequent inspection and test frequencies, as necessary, based on inspection and test results, consistent with current staff positions and GALL Report AMP XI.E3.

As part of RAI B.2.21-1 the staff also requested the applicant to provide a summary of the applicant's recently identified operating experience concerning inaccessible low voltage power cables within the scope of license renewal. In its response dated May 5, 2011, the applicant referenced operating experience described in the applicant's response to GL 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," dated May 8, 2007. The applicant stated that no failures of 480 V cables were identified as part of the GL 2007-01 evaluation. The applicant did note instances where testing identified degraded 480 V cables. The applicant stated that these cables were replaced prior to failure of the cable or component. The applicant did not provide operating experience for inaccessible low and medium voltage power cables subsequent to the applicant's GL 2007-01 response. By letter dated June 20, 2011, the staff issued RAI B2.21-6 asking the applicant to provide a summary of inaccessible low and medium voltage cable operating experience (both test and operating) subsequent to the May 8, 2007, Davis-Besse response to GL 2007-01.

In its response dated July 22, 2011, the applicant stated that subsequent to the May 8, 2007, response to GL 2007-01, diagnostic testing continues for both low voltage and medium voltage cables. The applicant also stated that the cable replacement program for wetted medium voltage cables continues; and, for low voltage cables, cables are replaced prior to loss of function based on diagnostic test results. The applicant stated that testing has identified two additional low voltage cables where the polarization index was less than desired, and the cables are scheduled for replacement. The applicant further stated that, regarding low voltage cable operating experience, a search of records in the FENOC Corrective Action Program did not identify any inservice low voltage cable failures.

In its response the applicant did identify additional medium voltage cable failures subsequent to GL 2007-01. The applicant stated that a 4,160 V cable A phase feed to the service water pump 3 motor was replaced as part of the cable replacement program. The applicant also identified cable BPAD211B, a 4,160 V feed to transformer 2, as failed in service and replaced. Cable BPAD211B was identified in the applicant's medium voltage replacement program as being monitored based on test results. The staff finds the applicant's response to RAIs B.2.21-1 and B.2.21-6 acceptable because the responses provide additional operating experience subsequent to the applicant's response to GL 2007-01 to demonstrate that the applicant can adequately manage the detrimental effects of aging within the scope of the program and that the applicant has taken corrective actions.

Based on its audit and review of the applicant's response to RAI B.2.21-1 and B.2.2.21-6, the staff finds that elements one through six of the applicant's Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program are consistent with the corresponding program elements of GALL Report AMP XI.E3 and, therefore, are acceptable. The staff's concerns described in RAIs B.2.21-1 and B.2.21-6 are resolved.

Operating Experience. LRA Section B.2.21 summarizes operating experience related to the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program. The applicant stated that a review of plant operating experience identified aging effects that require aging management for the period of extended operation. Specifically, the applicant noted that cables have been identified with degraded insulation with one of the primary causes being cable wetting. The applicant also stated that failures of medium voltage cable have been experienced with cables in-scope and out of scope of license renewal. The applicant referenced their response to GL 2007-01, which provides information on inaccessible or underground cable failures and degraded cables found during testing prior to failure. A review of the GL response noted seven medium voltage cable failures experienced at Davis-Besse with three failures noted for the same cable over approximately an 8-year period. This cable was subsequently replaced along with the other failed medium voltage cables identified in the applicant's GL 2007-01 response. The applicant's response did not identify any failures of 480 V cable but did identify additional cable, including 480 V cable, that testing identified as degraded prior to failure. The applicant stated that these cables were also replaced.

The applicant identified that, as part of the maintenance rule, it performed inspections on electrical manholes. These maintenance rule inspections are concerned with manhole structures including concrete, barrier integrity, and leakage. The applicant also stated that in-scope manholes have preventive maintenance orders that include visual checks of conduit and raceway supports and perform functional tests of sump pumps as applicable. The applicant further stated that, if water is found, the water is pumped from the manhole. The LRA states that in-scope manhole inspections were performed in the 2005–2008 time frame with no submergence of safety-related cables noted. However, the staff noted that, in the staff's Problem Identification and Resolution Inspection Report No. 05000346/2004017 dated January 2005, a finding of very low significance was identified by the inspectors. The low significance finding concerned the failure to identify and implement adequate and timely actions to address several underground wetted cable issues (water intrusion) and repeated occurrence of underground cable failures. The applicant documented the finding in its Corrective Action Program.

During the audit, the staff reviewed manhole preventive maintenance procedures for in-scope manholes. The manhole inspection interval varied by procedure but was either performed on a 12-month or 36-month schedule. The inspection attributes also varied by procedure but included documenting as-found water levels, removing water as required, sump pump functional tests, and inspection of raceway and supports. The staff noted that procedures did not specifically require inspection and confirmation that in-scope inaccessible power cables were not submerged. In addition, it was not clear to the staff if manholes not within the scope of license renewal but equipped with sump pumps, are required to limit exposure of in-scope manholes and cable from significant moisture. The staff reviewed more recent in-scope manhole inspections performed by the applicant for the period of 2008–2010. The staff review noted satisfactory results for all in-scope manholes except for two interconnected manholes (MH3044 and MH3045) that were found full of water with cables submerged. Neither manhole is equipped with a sump pump. Integrated Inspection Report 05000346/2009-005 dated January 13, 2010, also documented MH3045 to be flooded on November 5, 2009, with cables submerged. The inspection report also noted that MH3045 was found flooded previously on June 4, 2009. The in-scope submerged cables routed through MH3045 carry the output of the station blackout (SBO) diesel generator (SBODG). The issue was identified by the staff as unresolved item URI05000346/2009005-05. Inspection Report 05000346/2010-002, dated April 27, 2010, further noted that the applicant generated a condition report to address the issue and provided additional information to close the unresolved item. The inspection report identified the submerged cables as a finding of very low safety significance (green) for the applicant's failure to maintain these cables in an environment consistent with the cable design. The inspection report also noted that, in addition to MH3045 being found flooded on June 4, 2009, and again in November of 2009, manhole MH3045 was also found full of water on January 27, 2010. Following the November inspection, the applicant changed the manhole inspection interval to 84 days (December 2009) and, subsequently, installed a temporary sump pump. The applicant entered the issue into the applicant's Corrective Action Program, which included evaluating the need for a permanent sump pump installation for MH3045.

In response to operating experience for inaccessible cable wetting issues, cable failures, and cable test results, the applicant initiated a Medium Voltage Wetted Cable Replacement Program. The program prioritizes cable replacements based on risk significance, length of time the cable is energized, age of cable, insulation type, and classification of connected equipment. The applicant tracks and maintains this program through quarterly system health reports. The staff reviewed the system health reports for the fourth quarters of 2008, 2009, and 2010. The system health reports include inaccessible medium voltage cable status including whether the cable has been either replaced, scheduled for replacement, or is to be monitored. The quarterly health reports also identify industry operating experience for the quarter applicable to the Medium Voltage System Program. The staff noted that only inaccessible medium-voltage cables within the scope of license renewal are included in the program.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of plant operating experience including manhole inspection and cable inspection and test information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. Further, the staff performed a search of regulatory operating experience for at least the past 10-year period through November 2010. Databases were searched using various key word searches and then reviewed by technical auditor staff. During the audit, the staff reviewed the results of in-scope manholes inspected either by the applicant or the staff.

During its review, the staff identified operating experience, which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

GALL Report AMP XI.E3 states that periodic actions are taken to prevent inaccessible cables from being exposed to significant moisture, such as identifying and inspecting in-scope accessible cable conduit ends and cable manholes for water collection and draining the water, as needed. The staff noted that, based on work orders, corrective actions, system health reports, and inspection reports, manhole MH3045 has continued to experience water intrusion and cable submergence. Corrective actions have included increased inspection frequencies and, more recently, the installation of a temporary sump pump to limit the exposure of inaccessible power cables to significant moisture.

By letter dated April 5, 2011, the staff issued RAI B.2.21-2 requesting the applicant to provide a license renewal commitment to implement the corrective actions (such as permanent sump pump, cable replacement, increased inspection frequencies, and testing) for manhole MH3045. The staff finds that such a commitment will prevent in-scope inaccessible power cables from being exposed to significant moisture (cable wetting or submergence).

In its response dated May 5, 2011, the applicant stated that "a permanent sump pump, DP-P190, has been installed in manhole MH3045 to prevent the cables from being exposed to significant moisture." In addition, the applicant stated that the frequency of manhole inspections for accumulated water will be established and adjusted based on plant-specific inspection results, and manhole inspections will be performed in response to event-driven occurrences (e.g., heavy rain or flooding).

The addition of sump pump DB-P190 to manhole MH3045 addresses the staff concern with MH3045 and interconnected manhole MH3044 operating history of water intrusion and in-scope cables subjected to significant moisture. The modification of MH3045, along with cable testing and manhole inspection, provides reasonable assurance that these cables will continue to perform their intended function during the period of extended operation. The staff's concern identified in RAI B.2.21-2 is resolved.

During the audit, the staff also noted that plant work orders developed to inspect manholes including manholes within the scope of license renewal do not specifically require documentation of whether in-scope inaccessible cables are found submerged. Although procedures inspect for water level and pumping out of any water found, the maintenance work orders do not have an action to identify in-scope cables found submerged. Without this step, it is not clear to the staff how cables subjected to significant moisture are identified and corrective actions taken.

By letter dated April 5, 2011, the staff issued RAI B.2.21-3 requesting the applicant to explain how in-scope inaccessible power cables that are subjected to significant moisture will be identified and corrective actions taken, with the effects of aging adequately managed such that the intended function(s) will remain consistent with the CLB for the period of extended operation.

In its response dated May 5, 2011, the applicant stated the following:

> Although the Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program is a new program, preventive maintenance activities (PM 4297, PM 4294, PM 8025, and PM 4296) exist for inspection of water accumulation in the manholes associated with in-scope inaccessible non-EQ power cables. As an enhancement to the program, these preventive maintenance activities will include a requirement to generate a condition report in cases where the inspection identified submerged cables.

The applicant also stated that LRA Section B.2.21 will be revised to include the above enhancement, and LRA Table A-1, Commitment No. 11 is revised to include the generation of a condition report where in-scope inaccessible non-EQ power cable manhole inspections identify submerged cables. The staff finds the revision of LRA Section B.2.21 and Commitment No. 11 acceptable because the applicant will identify and generate a corrective action report for in-scope inaccessible power cables found to be submerged during manhole inspections. The applicant's action is consistent with those in GALL Report AMP XI.E3, which state that if water is found during inspection (i.e., cable exposed to significant moisture), corrective actions are taken to keep the cable dry and assess cable degradation. The staff's concern described in RAI B.2.21-3 is resolved.

During the audit, the staff reviewed drawings provided by the applicant and noted that some of the in-scope manholes do not have sump pumps but drain to manholes not within the scope of license renewal that have a sump pump. It is not clear to the staff that the sump pumps located in manholes not within the scope of LRA AMP B.2.21 but connected through common drainage systems (a common sump for the duct bank system) would be inspected or functionally tested. Because these sump pumps may be used to prevent in-scope inaccessible power cables from being exposed to significant moisture, the staff is concerned that these sump pumps not located in in-scope manholes may not be inspected or functionally tested under LRA AMP B.2.21.

By letter dated April 5, 2011, the staff issued RAI B.2.21-4 requesting the applicant to explain how sump pumps not included in in-scope manholes but used to prevent in-scope inaccessible power cables from being exposed to significant moisture are inspected and functionally tested with the associated in-scope manholes under LRA AMP B.2.21.

In its response dated May 5, 2011, the applicant stated the following: "with the recent addition of a permanent sump pump installed in manhole MH3045, the in-scope manholes either have a sump installed or drain to an in-scope manhole that has a sump pump installed."

The applicant also stated that preventive maintenance activities include functional testing of sump pumps associated with in-scope manholes. The staff finds the applicant's response acceptable because the applicant installed a sump pump in MH3045 and confirmed in-scope manholes either have sump pumps installed or drain to in-scope manholes equipped with sump pumps. The staff's concern described in RAI B.2.21-4 is resolved.

System health reports (including 2010-04) and other site documents reference the Medium Voltage Wetted Cable Replacement Program as a system improvement plan. The system health reports indicate that risk significant medium voltage underground cables will be replaced periodically.

By letter dated April 5, 2011, the staff issued RAI B.2.21-5 requesting the applicant to provide a discussion of the Medium Voltage Wetted Cable Replacement Program as applicable to license renewal. The staff also requested the applicant to discuss criteria for replacement, including prioritization or deferred replacement with monitoring (testing). In addition, the staff requested that the applicant provide information detailing the in-scope inaccessible power cables (including 400 V to 2 kV as applicable) included in the replacement program, the number of in-scope inaccessible power cables replaced, and the planned schedule for in-scope inaccessible power cable replacement or monitoring (testing).

In its response dated May 5, 2011, the applicant stated the following:

> The medium-voltage wetted cable replacement program includes 24 cables […] that are within the scope of license renewal and other cables that are not within the scope of license renewal. The medium voltage wetted cable replacement program originated through the FENOC Corrective Action Program pursuant to

the requirements of 10 CFR 50, Appendix B, Criterion XV and Criterion XVI. Cable replacement is based on (1) risk significance, (2) length of time a cable is energized, (3) cable age, (4) insulation type, and (5) connected equipment.

The applicant identified the cables within the scope of license renewal that have been replaced and in-scope cables scheduled for replacement. In-scope inaccessible power cables associated with the in-scope SBO diesel were tested with satisfactory results. Based on test results, in-scope SBO cables are currently tested every 2 years and are not currently scheduled for replacement. Based on operating experience including test results, in-scope inaccessible low voltage cable (400 V) are not scheduled for replacement under the Medium Voltage Replacement Program but are monitored through testing.

The staff finds the applicant's response acceptable because the applicant identified the in-scope inaccessible medium voltage cables within the scope of license renewal that have been replaced, the priority for replacement, and the planned schedule, if any, for replacement. In addition, in-scope inaccessible low voltage power cables are monitored through testing and inspection. The staff's concern described in RAI B.2.21-5 is resolved.

Based on its audit, review of the application, and review of the applicant's responses to RAIs B.2.21-1, B.2.21-2, B.2.21-3, B.2.21-4, B.2.21-5, and B.2.21-6, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.21 provides the USAR supplement for the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program.

The staff reviewed this USAR supplement description of the program against the recommended description for this type of program, as described in SRP-LR, Revision 2, Table 3.0-1. The staff finds that the USAR supplement description is not consistent with the SRP-LR, Revision 2, Table 3.0-1 or GALL Report AMP XI.E3 in the following areas:

- significant voltage exposure
- 400 V to 2 kV inaccessible power cables not in-scope
- manhole inspection frequency
- cable testing frequency
- event-driven inspections
- cable test frequency updated as required based on test results
- manhole inspection frequency established and adjusted based on plant-specific inspection results

By letter dated April 5, 2011, the staff issued RAI B.2.21-1 requesting the applicant to explain, based on recent industry, plant-specific operating experience, and current staff positions, how Davis-Besse will manage inaccessible power cable aging effects. The staff also requested the applicant to include an assessment of the USAR summary description and applicable license renewal commitments, to demonstrate reasonable assurance that the intended functions of inaccessible power cables subject to adverse localized environments (subject to significant moisture) will remain consistent with the CLB throughout the period of extended operation.

In its response dated May 5, 2011, the applicant revised LRA Section A.1.21 to include the following enhancements:

- The significant voltage exposure definition (medium voltage cable 2 kV to 35 kV subjected to system voltage for more than 25 percent of the time) is removed as a scope of program criterion.
- The “Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program” is expanded to include 400 V to 2 kV in-scope inaccessible low voltage power cables.
- The performance of manhole inspections is increased to at least once per year.
- The testing of inaccessible cables (400 V to 35 kV) for degradation of cable insulation will be performed at least every 6 years.
- Event-driven inspections (e.g., heavy rain or flood) are incorporated into the “Inaccessible Power Cables Not Subject to 10 CFR 50.49 EQ Requirements Program.”
- Cable test frequency will be updated as required based on test results.

As part of the applicant’s response to RAI B.2.21-1 the applicant revised the LRA USAR summary description for the Inaccessible Power Cables Not subject to 10 CFR 50.49 EQ Requirements Program but did not state that the inspection frequency for water collection is established and performed based on plant-specific operating experience with cable wetting or submergence, consistent with SRP-LR, Revision 2, Table 3.0-1 and GALL Report AMP XI.E3.

By letter dated June 20, 2011, the staff issued RAI B2.21-7 requesting the applicant explain why the USAR summary description provided in the response to RAI B.2.21-1 did not include the provision that manhole inspection frequencies will be based on plant-specific operating experience consistent with SRP-LR, Revision 2, Table 3.0-1 and GALL Report AMP XI.E3.

In its response dated July 22, 2011, the applicant stated that LRA Sections A.1.21 and B.2.21 are revised to state that the inspection frequency for water collection in manholes is established and performed based on plant-specific operating experience with cable wetting or submergence. The applicant’s response is acceptable because the applicant’s LRA Sections A.1.21 and B.2.21 are now consistent with GALL Report AMP XI.E3, and SRP-LR, Revision 2, Table 3.0-1, with respect to incorporating plant-specific operating experience into the determination of manhole inspection frequencies. The staff’s concerns identified in RAIs B.2.21-1 and B2.21-7 are resolved.

With the information provided by the applicant’s RAI responses, the staff finds the USAR and Commitment No. 11 with respect to GALL Report AMP XI.E3 and SRP SRP-LR, Revision 2, Table 3.0-1 acceptable because the enhancement is consistent with industry and plant-specific operating experience, current staff positions, GALL Report AMP XI.E3, and SRP-LR Section A.1.2.3.10.

The staff also noted that the applicant committed (Commitment No. 11) to implement the new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement, as amended by the applicant's RAI B.2.21-1 and RAI B2.21-7 responses, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program and RAI responses, the staff finds the program elements consistent with the GALL Report, including the incorporation of 400 V to 2 kV inaccessible power cables, and are consistent with industry and plant-specific operating experience and current staff recommendations. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Inservice Inspection (ISI) Program—IWE

Summary of Technical Information in the Application. LRA Section B.2.22 describes the existing Inservice Inspection (ISI) Program—IWE as consistent with GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE." The LRA states that the Inservice Inspection (ISI) Program—IWE includes examination or testing, or both, of accessible surface areas of the steel containment vessel; containment hatches and airlocks; seals, gasket and moisture barriers; and containment pressure-retaining bolting. This complies with ASME Code, Section XI, 1995 Edition through the 1996 Addenda, which is the applicable ASME Code for the current third 10-year inspection interval. The LRA further states that the inservice examinations conducted throughout the service life of the plant will continue to comply with the requirements of the ASME Code Section XI edition and addenda incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the inspection interval.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.S1. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.S1, with the exception of the "scope of program" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

In GALL Report AMP XI.S1, the "scope of program" element states that components within the scope of Subsection IWE are Class MC pressure-retaining components and their integral attachments; metallic shell and penetration liners of Class CC containments and their integral attachments; containment seals and gaskets; containment pressure-retaining bolting; and metal containment surface areas, including welds and base metal. However, it is not clear from a review of the program basis document for the AMP that piping penetrations are included in the scope of the program. In addition, LRA Section 4.6.2 states that a search of the Davis-Besse CLB did not identify any pressurization cycles or fatigue analyses for containment penetration assemblies. Containment stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components, which are subject to cyclic loading but have no CLB fatigue analysis, are required to be monitored for cracking. Therefore, by letter dated April 5, 2011, the staff issued

RAI B.2.22-4 asking the applicant to clarify if the ASME Section XI, IWE AMP monitors steel penetration sleeves, dissimilar metal welds, bellows, and steel components for cracking due to cyclic loading.

In its response dated May 24, 2011, the applicant stated that, in accordance with 10 CFR 50.55a(b)(2)(ix), the examination of the Category E-B pressure retaining welds and Category E-F pressure retaining dissimilar metal welds are not scheduled since these examinations are optional; however, the Inservice Inspection (ISI) Program—IWE does include the Category E-A examination of containment surfaces. The applicant also stated that the 10 CFR Part 50, Appendix J Program detects evidence of leakage as part of the Category E-P examinations.

The staff is concerned that stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components, which are subject to cyclic loading but have no CLB fatigue analysis, are not being monitored for cracking as recommended in GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE." Therefore, by letter dated July 21, 2011, the staff issued RAI B.2.22-7**,** requesting the applicant to describe how the applicant will be consistent with the GALL Report recommendations concerning the inspection of the steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no CLB fatigue analysis.

In its response dated August 17, 2011, the applicant stated that the Inservice Inspection (ISI) Program—IWE is revised to include an enhancement to monitor for cracking of containment stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no CLB fatigue analysis. The applicant further stated that the enhancement will be implemented prior to the period of extended operation.

The staff finds the applicant's response acceptable because the applicant has committed (Commitment No. 47) to enhance the Inservice Inspection (ISI) Program—IWE to include examinations to monitor for cracking of stainless steel containment penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no CLB fatigue analysis, prior to entering the period of extended operation. This commitment is consistent with the recommendations of GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and, therefore, is acceptable. The staff's concerns described in RAIs B.2.22-4 and B.2.22-7 are resolved.

Based on its audit and review of the applicant's response to RAIs B.2.22-4 and B.2.22-7, the staff finds that elements one through six of the applicant's Inservice Inspection (ISI) Program—IWE are consistent with the corresponding program elements of GALL Report AMP XI.S1 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.22 summarizes operating experience related to the Inservice Inspection (ISI) Program—IWE. The applicant stated that containment examinations and tests required by the Inservice Inspection (ISI) Program—IWE have been implemented in accordance with the established schedule. The applicant also stated that there have been three conditions identified that have required engineering evaluation or repair or replacement activities. These included seepage of water; scaling, and pitting of containment vessel surface in the sand pocket region and presence of gaps between containment vessel and concrete ledge, at two locations, at the base slab level inside the containment at 565 ft elevation. The applicant also stated that visual and ultrasonic thickness (UT) measurements of the containment shell in the affected regions were performed and found to be acceptable. In addition, scaled and pitted containment surface was recoated, moisture barrier installed in the sand pocket region to prevent seepage of water, and floor drains in sand pocket regions were unplugged. The applicant further stated that all of the examinations scheduled since the third period of the second inspection interval have been completed, and all examinations and tests performed to date have satisfied the acceptance standards contained within ASME Code, Section XI, IWE-3000.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

In GALL Report AMP XI.S1, the "acceptance criteria" element recommends that the areas found to be suspect during visual examination require an engineering evaluation or require correction by repair or replacement. During the audit, the staff found that there is history of groundwater infiltration into the annular space between the concrete shield building and steel containment. The staff reviewed documentation indicating the presence of standing water in the annulus sand pocket region. In addition, the staff reviewed photographs that indicate peeling of clear coat on the containment vessel annulus area and degradation of the moisture barrier, concrete grout, and sealant in the annulus area that were installed in 2002–2003. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.22-1 requesting the following:

(1) plans and schedule to perform nondestructive examinations (NDEs)

(2) the condition of the drains located in the sand pocket region and clarification that the water exiting these drains is monitored

3) plans and schedule to remove, replace, or repair degraded grout, moisture barrier, and sealant

(4) corrosion rate in the inaccessible area of the steel containment

(5) with the established corrosion rate, demonstration that the steel containment will have sufficient thickness to perform its intended function through the period of extended operation

In its response dated May 24, 2011, the applicant stated the following for each of the requested pieces of information:

(1) The applicant plans to perform nondestructive testing (NDT) of the steel containment in the sand pocket region and complete the evaluation of the NDT results prior to entering the period of extended operation. It plans to perform NDT at a minimum of three representative locations. At each location, the applicant plans to include the areas below and above the grout. Based on the NDT results, the applicant will use the Corrective Action Program to evaluate the need for and frequency of future NDT to monitor the extent of aging of the steel containment in the sand pocket region for areas where water seepage is identified.

(2) The drains located in the sand pocket region are functional. The water exiting from the drains is not monitored locally.

(3) The applicant plans to continue to minimize water seepage into the sand pocket area by continuing to inspect and maintain the accessible materials in the annulus sand pocket area. It plans to inspect the annulus so as to continue to direct water seepage away from the grout-containment vessel interface.

(4) The applicant had a thorough containment vessel corrosion evaluation conducted in July of 2002. The report of that evaluation concluded that the integrity of the containment vessel will be maintained with negligible additional corrosion in the future. The planned NDT described in the response to item 1 will confirm the conclusion stated in the report of the 2002 evaluation.

(5) The planned NDT, described in the response to item 1 above, will determine the current steel containment thickness. The actual thickness will be evaluated to ensure that the steel containment will have sufficient thickness to perform its intended function through the period of extended operation, or the applicant's Corrective Action Program will be used to identify and track remedial orders.

The staff finds that the applicant's response to RAI B.2.22-1 did not explain why a one-time NDT examination at three locations in the sand pocket region, prior to the period of extended operation, is appropriate in lieu of ASME Code, Section XI, IWE-1241(a) and Table IWE-2500-1 requirements. The staff's concern is that a one-time NDT (UT) examination at three locations in the sand pocket region that is about 300–400 ft long, prior to the period of extended operation, may not be able to detect and establish a trend of the potential degradation of the steel containment over the long term. Therefore, by letter dated July 21, 2011, the staff issued RAI B.2.22-5 requesting the applicant to provide the following:

- technical justification for not following the requirements of ASME Code, Section XI, IWE-1241(a) and Table IWE-2500-1 for performing UT examination of 100 percent of the area designated for augmented examination during each inspection period until the area remains essentially unchanged for three consecutive inspection periods
- details and schedule of specific actions that FENOC has planned to minimize water seepage into the sand pocket region
- specific details and requirements for inspection, maintenance, and repair of the annulus sand pocket accessible and inaccessible areas, including the replacement of deteriorated grout and coating

In its response dated September 16, 2011, the applicant stated that ASME Code, Section XI, Subsection IWE-1241 is not applicable to the subject inaccessible surfaces of the containment vessel that is embedded in concrete and that FENOC plans to continue to monitor the sand pocket region for aging degradation. The applicant stated that pooling of the groundwater against the containment vessel surface is minimized by annulus drains and by grout installed with a slope to direct water away from the containment vessel toward the shield building side of the annulus. The applicant also stated that no specific actions are planned to further minimize water seepage into the sand pocket region. The applicant further stated that undefined pathways of groundwater seepage located below the surface of the annulus sand pocket region and the inaccessibility of the shield building foundation preclude practical repairs for full mitigation of the groundwater leakage.

In its response, the applicant stated that FENOC plans to revisit this approach after each of the containment vessel inspections or if the quantity of seepage or chemistry of the groundwater seepage indicates that further efforts to minimize seepage are necessary. The applicant revised Commitment No. 36 to include the following:

- perform 100 percent visual inspection of the wetted outer surface of the containment vessel in the sand pocket region during each refueling outage (RFO)
- record and evaluate indications of pitting or MIC, if found during inspections
- take water samples during RFOs for chemical analyses whenever sufficient water volumes are available in the sand pocket region
- perform visual inspection for deterioration of the grout during each RFO

The applicant also stated if sufficient water is available, the samples are planned to be analyzed for pH, chlorides, iron, and sulfates. If the concentration of chlorides is determined to be greater than 250 parts per million (ppm), the sand pocket region is planned to be treated or washed, or some combination thereof, to reduce the measured chloride concentrations to less than 250 ppm. The applicant stated that it plans to enter descriptions of deteriorated grout areas into its Corrective Actions Program for evaluation and corrective actions to address the conditions. The applicant further stated that visual inspection of the containment vessel coating, accessible from the annulus, is included in the existing maintenance rule structures evaluation procedure that is being enhanced for the license renewal Structures Monitoring Program.

The staff reviewed the revised Commitment No. 36 and found it acceptable for monitoring the degradation of the grout in the sand pocket region. The staff finds that visual examination of the grout and sampling of the water in the sand pocket region for chloride concentration will minimize the containment vessel exposure to an environment conducive to corrosion. However, the staff was concerned about the condition of containment exterior moisture barrier located in the sand pocket region. ASME Code, Section XI, Subsection IWE, Article IWE-3513 requires that seals, gaskets, and moisture barriers shall be examined for wear, damage, erosion, tear, surface cracks, or other defects that may violate the leak-tight integrity. ASME Section XI, Subsection IWE states that defective items shall be replaced. In addition, IWE Table 2500-1 requires that both the external and internal moisture barrier materials at the concrete-to-metal interfaces shall be examined. The staff also finds that ASME Code, Section XI, Figure IWE-2500-2 clearly shows that external moisture barrier is within the scope of IWE examination. Therefore, a teleconference was held with the applicant on October 5, 2011, to discuss the staff's concerns with the applicant's response. A followup teleconference was held on November 14, 2011.

In response to the conference calls, by letter dated November 23, 2011, the applicant provided a supplemental response to RAI B.2.22-5. In its supplemental response, the applicant revised Commitment No. 36 to include visual inspection of the accessible surfaces of the containment exterior moisture barrier during each RFO. The applicant also stated that it will manage any degradation of the moisture barrier in accordance with its Corrective Action Program. The staff inspected the containment exterior moisture barrier during the cycle 17 mid-cycle outage in October 2011, and did not see any evidence of wear, damage, erosion, tears, or surface cracks in the moisture barrier. Therefore, the staff finds the applicant's commitment in Commitment No. 36 concerning the aging management of the grout and moisture barrier acceptable.

The staff reviewed the applicant's response to RAI B.22-5 concerning the presence of water in the containment annulus sand pocket region and finds it acceptable because the pooling of the groundwater against the containment vessel surface is minimized by annulus drains, and the grout in the annulus region is sloped toward the shield building which will direct water away from the containment vessel. In addition, the applicant committed (Commitment No. 36) to sample the water in the sand pocket region when sufficient volumes are available during each RFO. The sampled water will be analyzed for pH, chlorides, iron, and sulfates. If the concentration of chlorides in a sample exceeds 250 ppm, the sand pocket region will also be treated or washed to prevent potential corrosion of the steel containment.

In its September 16, 2011, response to RAI B.22-5, the applicant revised Commitment No. 35 to update the NDT plan for the steel containment vessel in the sand pocket region. The commitment now states that the containment vessel must be examined at least twice by taking UT thickness measurements from the outer surface in accordance with the following criteria:

- At five areas with previously identified groundwater in-leakage.
- A minimum of three vertical grid locations at 12 in. nominal horizontal spacing are planned to be examined at each of the above areas.
- At each of the above locations, the vessel is planned to be examined at a minimum of three elevations:

  (1) approximately 3 in. below the existing grout-to-vessel interface level in the sand pocket region

  (2) the existing grout-to-vessel interface level in the sand pocket region

  (3) approximately 3 in. above the existing grout-to-vessel interface level in the sand pocket region

- The first examination is planned to be performed in 2014 and a second examination is planned to be performed by 2025.

In its commitment (Commitment No. 35), the applicant also stated that it plans to compare the UT thickness measurements to the minimum ASME Code vessel thickness requirements and the results obtained during previous UT thickness examinations of the containment vessel. The applicant further stated (Commitment No. 35) that the need for maintenance or repair of the containment vessel is planned to be determined based on the results and evaluation of the examinations. The applicant further stated in its response to RAI B.22-5 that the 2014 and 2025 UT examination results (Commitment No. 35), combined with visual examination during each RFO (Commitment No. 36), should provide sufficient information for detection of a trend of the potential degradation of the steel containment vessel over the longer term.

The staff reviewed the applicant's response to RAI B.22-5 and finds that the applicant's commitment (Commitment No. 35) to perform UT examination at five areas of previously identified groundwater in-leakage in 2014 and 2025 is adequate to detect and establish a trend of potential degradation of the steel containment vessel. This commitment includes an evaluation to determine the need for maintenance and repair in the event that adverse conditions are identified from the UT examinations. An augmented examination of the containment exterior steel surface in accordance with IWE 1241 is not required at this time because a thorough containment vessel corrosion evaluation was performed by the applicant in July 2002. The evaluation concluded that the integrity of the containment vessel will be maintained with negligible additional corrosion in the future. In addition, as documented in CR 10-72660, the 2010 visual examination of the containment in the sand pocket region detected minor surface corrosion on the containment vessel with no loss of base material. This conclusion was supported by a comparison of photographs of the sand pocket region taken during 2010 and in previous RFOs. The applicant has also committed (Commitment No. 36) to perform a visual examination of the accessible areas of the outer surface of the containment vessel in the sand pocket region during each RFO and address any microbiologically-influenced corrosion (MIC) identified during the inspection using the Corrective Action Program. The applicant also committed to visual inspection of 100 percent of the accessible surfaces of the containment exterior moisture barrier during each RFO. The staff finds that the actions described in Commitments No. 35 and 36, along with the continued implementation of the ASME Section XI, Subsection IWE Program, provide reasonable assurance that the exterior surface of the steel containment will be adequately inspected and monitored during the period of extended operation. The staff's concerns described in RAIs B.22-1 and B.22-5 are resolved.

In GALL Report AMP XI.S1, the "scope of program" program element states that 10 CFR 50.55a(b)(2)(ix) specifies additional inspection requirements for inaccessible areas. It further states that the applicant is to evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas. During the site audit, the staff reviewed documentation indicating borated water leakage into the east-west tunnel and incore instrumentation tunnel from the refueling cavity. The borated water has degraded the concrete wall coating and corroded the conduits, piping, and supports in these tunnels. Based on the observed leakage, it is likely that borated water has also leaked on top of the embedded steel containment and may result in degradation and corrosion. By letter dated April 5, 2011, the staff issued RAI B.2.22-2 requesting that the applicant provide details of actions planned to examine the inaccessible portion of the steel containment.

In its response dated May 24, 2011, the applicant stated that, prior to entering the period of extended operation, it plans to access the inside surface of the embedded steel containment, which will allow verification of whether or not borated water has come in contact with the steel containment vessel. The applicant further stated that if there is evidence borated water has come in contact with the steel containment vessel, it will (1) conduct non-destructive testing to determine what effect, if any, the borated water has had on the steel containment vessel, and (2) perform a study to determine the effect of the loss of thickness in the steel containment due to exposure to borated water, through the period of extended operation.

The staff finds that the applicant's response to RAI B.2.22-2 does not provide specific details regarding the examination of the inaccessible portion of the steel containment that may be exposed to borated water leakage from the reactor cavity pool leakage. Therefore, by letter dated July 21, 2011, the staff issued RAI B.2.22-6 requesting the applicant to provide specific details, schedule, and location for accessing the inside surface of the embedded steel at the lowest point in containment and to provide details on how the applicant plans to continue to monitor and inspect the inside surface (inaccessible area) of the steel containment until the borated water leakage from the reactor cavity is stopped.

In its response dated August 26, 2011, the applicant stated that it is planning to perform a core bore to access the inside surface of the embedded containment vessel by the end of 2014. The applicant stated that it plans to locate the core bore below the RV where the incore tunnel opens through the primary shield wall into the area below the RV, a location 18 ft from the containment vessel centerline. The applicant stated that the lowest point of the containment vessel is about 30 in. lower than the elevation of the containment bottom head at the core bore location. The applicant also stated that the inspection in 2014 will allow a visual inspection of the embedded surface of the containment vessel to determine if borated water is present. If water is found, the applicant plans to analyze the water for boron content, pH value, and iron content. The applicant further stated that regardless of whether water is found, it plans to collect samples of corrosion, boric acid residue, or other foreign material found at the surface of the containment vessel. If the concrete removal method provides large enough pieces of concrete, the applicant plans to perform petrographic examination of those pieces. The applicant stated that it plans to use UT measurements to determine the thickness of the containment vessel at the area accessed and to visually examine and evaluate reinforcing bar if it is exposed. The applicant further stated that if, based on the core bore inspection results and refueling canal leakage mitigation results, a second core bore may be necessary, it will plan to complete the second core bore by the end of 2020.

The staff finds the applicant's response acceptable because the applicant has committed (Commitment No. 39) to take a core bore by the end of 2014 (before the period of extended operation) to address the potential for borated water degradation of the steel containment vessel. The inaccessible portion of the containment vessel is 1 ½ inch thick steel and is sandwiched between concrete elements, and is not located in the high stress zone of the containment. Furthermore, previous 10 CFR 50 Appendix J integrated leak rate tests performed for the containment vessel have been satisfactory and have not identified any unidentified leakage path. If water is found at the core bore location, the applicant plans to analyze the water chemistry, collect samples found on the surface of the containment vessel, perform petrographic examinations if concrete samples are large enough, take UT measurements, visually inspect reinforcing bar if exposed, and conduct future core bores and UT measurements if refueling canal leakage continues. The staff finds that these activities will provide reasonable assurance that the inside surface of the steel containment will be adequately inspected and monitored.

After preparing to take the core bore discussed above, the applicant identified an inspection location it believed would better accomplish the goals of Commitment No. 39. This was discussed during a telephone conference call with the applicant on May 9, 2013, and by letter dated May 21, 2013, the applicant supplemented its response to RAI B.2.22-6. In its supplemental response, the applicant explained that the original proposed core bore location (location 1) was difficult to access and located in a high radiation area. The applicant stated that the new proposed location (location 2) is in a more accessible location with better radiation shielding. The applicant also stated that this location supports as low as is reasonable achievable (ALARA) dose reduction principles. The applicant explained that location 2 is closer to the centerline and the bottom of the containment vessel. Based on the applicant's estimates, location 1 is approximately 24 inches vertical height above the bottom of the vessel, while location 2 is less than approximately 10 inches vertical height above the bottom. The applicant further stated that location 1 was originally selected because of boron deposits found near the site of location 1. Testing was planned for the concrete removed from this location and that same testing will be done on concrete removed from location 2. The applicant explained that moving to location 2 was still acceptable because if focused Commitment No. 39 on addressing the adequacy of the steel containment vessel, while existing Commitment No. 33 focuses on concrete exposed to borated water leakage in the south wall of the east/west core flood pipe tunnel.

The staff reviewed the applicant's supplemental response and noted that location 2 is lower on the containment vessel and closer to the exact center of the vessel. This increases the likelihood that any possible degradation due to borated water ponding will be identified. The staff also noted that the original location allowed for testing of concrete that had been exposed to borated water, which may have weakened the concrete. However, any concern with concrete degradation will still be addressed via Commitment No. 33, in which the applicant committed to test concrete that has been exposed to borated water leakage from the refueling canal. The staff finds the new location acceptable because it is closer to the bottom of the containment vessel and, therefore, more likely to detect degradation due to possible borated water ponding on the inner surface of the vessel. In addition to identifying possible degradation due to ponding on the interior surface of the vessel, UT measurements of the vessel at location two will identify any possible degradation due to contact with groundwater on the exterior surface. This supports Commitments No. 35 and 36 and provides additional assurance that the containment vessel will be properly age managed during the period of extended operation.

In order to ensure that the inaccessible portion of the containment vessel is not degraded and can perform its intended function through the period of extended operation, the staff plans to impose a condition upon the renewed license, which will state:

> FENOC will access the inside surface of the embedded steel containment, via core bore, by December 31, 2014. If there is evidence of the presence of borated water in contact with the steel containment vessel, the applicant will conduct non-destructive testing to determine the effect, if any, that the borated water has had on the containment vessel. The applicant will perform an evaluation of the effect of any loss in containment vessel thickness due to exposure to borated water through the period of extended operation. If the loss in containment vessel thickness exceeds 10 percent of the nominal wall thickness, the applicant will submit to the NRC a report consisting of a summary of the results of the core bore and associated evaluations within 90 days following the completion of testing. If water is detected in the first core bore, or if the refueling cavity leakage continues, the applicant will perform a second core bore by December 31, 2020. At that time, the applicant will perform an evaluation of the effect of any loss in containment vessel thickness through the remainder of the period of extended operation. If there is greater than 10 percent loss in containment vessel thickness, a summary of the core bore results and associated evaluations shall be submitted to the NRC staff within 90 days following the completion of testing.

The staffs concerns described in RAIs B.2.22-2 and B.2.22-6 are resolved.

GALL Report AMP XI.S1, “operating experience” program element recommends that steel containment corrosion concerns described in the staff generic communication should be considered. In addition, GALL Report AMP XI.S1 states that the ASME Code Section XI, Subsection IWE requires examination of coatings that are intended to prevent corrosion. By letter dated April 5, 2011, the staff issued RAI B.2.22-3 asking the applicant to clarify if the Inservice Inspection (ISI) Program—IWE inspects and credits coatings on the inside surface of the steel containment for corrosion protection.

In its response dated May 24, 2011, the applicant stated that the steel vessel is inspected by the Inservice Inspection (ISI) Program—IWE in accordance with GALL Report AMP XI.S1, “ASME Section XI, Subsection IWE.” The applicant further stated that the program does inspect surfaces that are coated, but the coating is not credited for corrosion protection as part of the AMR. The applicant also stated that the acceptance criteria for flaws found during the inspection comply with IWE-3000—specifically, IWE-3510 for containment surfaces.

Based on its review, the staff finds the applicant's response to RAI B.2.22-3 acceptable because the Inservice Inspection (ISI) Program—IWE does inspect surfaces that are coated, and the acceptance criteria comply with IWE-3000 for flaws found during the inspection. IWE-3510 requires visual inspection of coated areas for flaking, blistering, peeling, discoloration, and other signs of distress by a registered professional engineer or other individual, knowledgeable in the requirements for design, ISI, and testing of metal containments. In addition, in accordance with the LRA, Davis-Besse does not credit coatings inside the containment to manage the effects of aging for SCs or to ensure that the intended function of coated SCs are maintained. Furthermore, in a letter dated June 17, 2011, the applicant added a separate AMP in LRA Section B.2.42, "Nuclear Safety-Related Coatings Program," for monitoring the performance of Service Level 1 coatings inside containment through periodic coating examination. Therefore, the staffs concern described in RAI B.2.22-3 is resolved.

Based on its audit and review of the application, review of the applicant's response to RAIs B.2.22-1, B.2.22-2, B2.22-3, B.2.22-5, and B.2.22-6, and the proposed license condition, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

<u>USAR Supplement</u>. LRA Section A.1.22 provides the USAR supplement for the Inservice Inspection (ISI) Program—IWE. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.5-2. The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its review of the applicant's Inservice Inspection (ISI) Program—IWE, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that with their proposed program, and with the proposed license condition, the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR 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 Inservice Inspection (ISI) Program—IWF

<u>Summary of Technical Information in the Application</u>. LRA Section B.2.23 describes the existing Inservice Inspection (ISI) Program—IWF as consistent with GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF." The applicant's Inservice Inspection (ISI)—IWF Program consists of visual inspection of ASME Code Classes 1, 2, and 3 supports in accordance with the requirements of the ASME Code, Section XI, 1995 Edition through the 1996 Addenda. The LRA states that the program is based on sampling of the total support population. The largest sample size is specified for the most critical supports (ASME Code Class 1), and the sample size decreases for the less critical supports (ASME Code Classes 2 and 3). The applicant stated that the discovery of support deficiencies triggers an increase of the inspection scope to ensure that the program identifies the full extent of deficiencies. The applicant also stated that degradation that potentially compromises support function or load capacity is identified for evaluation.

The applicant further stated that the inservice examinations conducted as part of the IWF Program will continue to comply with the requirements of the ASME Code Section XI edition and addenda incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the inspection interval, which is consistent with NRC Statements of Consideration associated with the adoption of new editions and addenda of the ASME Code in 10 CFR 50.55a.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.S3. The staff noted that GALL Report AMP XI.S3 recommends that Class metal containment (MC) supports and vibration isolation elements be examined in accordance with the requirements of ASME Code, Section XI, Subsection IWF. During the onsite audit, the applicant stated that the Inservice Inspection (ISI) Program—IWF does not include MC supports or vibration isolation elements. The staff found this deviation from the recommendations in the GALL Report to be acceptable because Davis-Besse has no ASME Class MC supports, and the staff confirmed that there were no identified non-metallic vibration isolation elements. However, while conducting activities in support of Inspection Procedure (IP) 71002, "License Renewal Inspection," during the week of August 22, 2011, the staff's discussion with the applicant resulted in the discovery that there were elastomeric vibration isolation elements in the plant. The applicant documented this condition in its Corrective Action Program and, by letter dated October 7, 2011, stated that LRA Section 2.4 and Section 3.5.2 are revised to include elastomeric vibration isolators in the list of in-scope elastomeric components, including elastomeric elements in vibration isolators. The applicant stated that the Structures Monitoring Program is credited for aging management of these components. The applicant also stated, by letter dated October 21, 2011, that it will enhance its Structures Monitoring Program as follows: (1) the "parameters monitored or inspected" program element will include monitoring elastomeric vibration isolators for cracking, loss of material, and hardening; (2) the "detection of aging effects" program element will include visual inspection of elastomeric vibration isolation elements to be supplemented by feel to detect hardening if the vibration isolation function is suspect; and (3) the "acceptance criteria" program element will be revised such that elastomeric vibration isolation elements are acceptable if there is no loss of material, cracking, or hardening that could lead to the reduction or loss of isolation function. The enhancements to the Structures Monitoring Program are included in Commitment No. 20 and will be implemented prior to April 22, 2017. The staff finds the applicant's response acceptable because, with enhancement, the program will follow the recommendations for aging management of elastomeric vibration isolation elements stated in the GALL Report.

As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.S3 with the exception of the "monitoring and trending" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

Element 5, "monitoring and trending," states that component supports should be examined periodically and that changes in component condition should be recorded in accordance with ASME Code Section XI, Subsection IWA-6230. During its audit, the staff noted that the LRA states that the applicant's Inservice Inspection (ISI) Program—IWF examinations comply with ASME Code, Section XI, Subsection IWF. Upon onsite review of the program basis documents, the staff was unable to determine whether the program follows the condition reporting requirements of IWA-6230. The staff determined that additional information was required. By letter dated April 20, 2011, the staff issued RAI B.2.23-1 requesting that the applicant explain how the condition recording requirements of ASME Code Section XI, Subsection IWA-6230 are satisfied by the applicant's Inservice Inspection (ISI) Program—IWF AMP.

In its response dated May 24, 2011, the applicant stated that its administrative procedure for the Inservice Inspection Program specifies that a summary report shall be created in accordance with the requirements of ASME Code Section XI, Article IWA-6000, which includes paragraph IWA-6230. Based on its review, the staff finds the applicant's response acceptable because the applicant clarified that it follows the condition reporting requirements of ASME Code Section XI, Subsection IWA-6230, as recommended in the GALL Report. The staff's concern described in RAI B.2.2.23-1 is resolved.

During review of the Bolting Integrity Program, the staff discovered the applicant had not adequately addressed its strategy for aging management of high-strength structural bolting in IWF applications. The staff discussed its concerns with the applicant through telephone conference calls held on April 11, April 24, May 2, and May 28, 2013, which led to the need for enhancement to the Inservice Inspection (ISI) – IWF AMP. The staff's evaluation of the applicant's response to the concerns raised during the telephone conference calls is documented in Section 3.0.3.2.2 of this SER. Therefore, by letter dated May 17, 2013, and as supplemented by letter dated June 4, 2013, the applicant revised LRA Section B.2.23 to enhance the "detection of aging effects" program element. The applicant enhanced the Inservice Inspection (ISI) Program – IWF AMP to include monitoring of ASTM A490 high-strength bolting (i.e., actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1 inch nominal diameter for cracking using volumetric examination. This is consistent with the staff's position as stated in Revision 2 of the GALL Report. The enhancement also includes monitoring of ASTM A540 high-strength bolting (i.e., actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1 inch nominal diameter for cracking using periodic visual inspection at an interval not to exceed 5 years. The applicant used a plant-specific justification to waive the volumetric examinations of high strength A540 bolts that are recommended in Revision 2 of the GALL Report. The staff's discussion of this enhancement is documented Section 3.0.3.2.2, "Bolting Integrity Program," of this SER.

Based on its audit and review of the applicant's response to RAI B2.2.23-1, the staff finds that elements one through six of the applicant's Inservice Inspection (ISI) Program-IWF are consistent with the corresponding program elements of GALL Report AMP XI.S3 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.23 summarizes operating experience related to the Inservice Inspection (ISI) Program—IWF. In the LRA, the applicant stated three examples of plant-specific operating experience related to the Inservice Inspection (ISI) Program—IWF, but no plant operating experience revealed age-related issues that impaired intended functions with regards to ASME Classes 1, 2, or 3 supports pertaining to ASME Code, Section XI, Subsection IWF. The applicant stated that there have been no conditions identified that have required engineering evaluation, repair, or replacement activities.

The applicant stated that while performing an ISI examination of hangers, rusted areas were recorded on I-beams supporting the service water piping, which appeared to be from the humidity condensing on the service water pipe and dripping onto the support I-beams. No evidence of material wastage was noted. The conditions were documented in the Corrective

Action Program and evaluated. However, the applicant stated that no corrective action was required.

The applicant cited another example of operating experience where in 2006, while performing a visual examination of a sway strut for the Inservice Inspection Program, proper thread engagement of the strut paddle bolts could not be confirmed through the sight hole in the sway strut barrel. This was applicable for both the north and south struts and top strut paddle bolts. The conditions were documented in the Corrective Action Program. According to the applicant, a review of the as-found condition of the sway strut upper pinned connections determined that the sway strut had been capable of performing its design function even with reduced thread engagement on one of the four threaded connections.

The staff reviewed operating experience information, in the LRA and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During the audit, the staff reviewed the cycle 15, 14, and 13 RFO ISI summary reports and did not find any age-related issue that impaired intended functions with regards to ASME Code Classes 1, 2, or 3 supports pertaining to ASME Section XI, Subsection IWF. In its search of the plant operating experience database, the staff did not find any operating experience that would indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.23 provides the USAR supplement for the Inservice Inspection (ISI) Program—IWF Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.5-2.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Inservice Inspection (ISI) Program—IWF, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 Inservice Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.24 describes the existing Inservice Inspection Program as consistent with GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant stated that this program manages cracking of RCPB components and once-through steam generator (OTSG) secondary side components. The applicant further stated that, in conjunction with the PWR Water Chemistry Program, this program manages loss of material for OTSG secondary side components. In addition, the applicant stated that this program manages reduction in fracture toughness for cast austenitic stainless steel (CASS) pump casings and valve bodies. The applicant also stated that this program includes periodic visual, surface, or volumetric examination and leakage (pressure) testing of ASME Code Classes 1, 2, or 3 components and their integral attachments, as well as repair, modification, or replacement of the same. The applicant stated that this program will continue to comply with the requirements of the ASME Section XI, Subsections IWB, IWC, and IWD, edition and addenda incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the inspection interval, subject to prior approval of the edition and addenda by the NRC.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M1. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M1, with the exception of the "scope of program" program element. For this element, the staff determined the need for additional information, which resulted in the issuance of an RAI.

GALL Report AMP XI.M1 states that the components described in ASME Code, Section XI, Subsections IWB-1220, IWC-1220, and IWD-1220 are exempt from the volumetric and surface examination requirements but not exempt from visual exam requirements of Subsections IWB-2500 and IWC-2500. During its audit, the staff found that the LRA exempts these components from the examination requirements of Subsections IWB-2500, IWC-2500, and IWD-2500 per the third 10-year Inservice Inspection Program plan.

By letter dated April 20, 2011, the staff issued RAI B.2.24-1 requesting that the applicant provide information showing that the required visual inspections are conducted on these components and, if they are not conducted, provide the technical reasons for not accomplishing these inspections. In its response dated May 24, 2011, the applicant stated that the basis document related to its Inservice Inspection Program has been updated to more clearly show that visual, surface, and volumetric exemptions per ASME Code, Section XI, Subsections IWB-1220, IWC-1220, are properly followed. Specifically, the applicant updated its basis document related to Inservice Inspection Program to clearly state that its Inservice Inspection Program complies with the ASME Code examination requirements for components described in Subsections IWB-1220, IWC-1220, and IWD-1220 of the ASME Code, Section XI, and that components described in Subsections IWB-1220 and IWC-1220 are not exempted from visual examination requirements of Subsections IWB-2500 and IWC-2500.

Based on its review, the staff finds the applicant's response acceptable because the examination requirements in the applicant's Inservice Inspection Program were updated to be consistent with Subsections IWB-1220, IWC-1220, and IWD-1220 of the ASME Code, Section XI, and consistent with GALL Report AMP XI.M1. The staff's concern described in RAI B.2.24-1 is resolved.

Based on its audit, and review of the applicant's response to RAI B.2.24-1, the staff finds that elements one through six of the applicant's Inservice Inspection Program are consistent with the corresponding program elements of GALL Report AMP XI.M1 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.24 summarizes operating experience related to the Inservice Inspection Program. The applicant indicated that this program is based on the ASME Section XI, Subsections IWB, IWC, and IWD, which is based on industry-wide operating experience, research data, and technical evaluations. The applicant indicated that plant-specific examples are documented in its ISI outage summary reports as well as in the Corrective Action Program records. Plant-specific operating experience in which an indication was found during a liquid penetrant testing examination was entered into the applicant's condition reports, and corrective actions were taken to disposition the indication. In another case, the applicant detected an indication on a drain line nozzle-to-elbow weld from its UT examination during an outage inspection in 2006, which exceeded the ASME Code acceptance criteria. To mitigate the indication, the applicant installed a full structural overlay on this weld and preemptively installed full structural overlays on all similar drain line welds. The staff also reviewed the applicant's ISI summary reports for Cycles 14 and 15 to verify that the applicant's implementation of the program was effective in detecting, trending, and correcting those aging effects for which the program was credited. Based on the staff review of these ISI summary reports, the staff did not note any evidence that would demonstrate that the program was ineffective in detecting the aging effects managed by this program.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.24 provides the USAR supplement for the Inservice Inspection Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR, Revision 2, Table 3.0-1.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Inservice Inspection Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 Lubricating Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.2.26 describes the existing Lubricating Oil Analysis Program as consistent with GALL Report AMP XI.M39, "Lubricating Oil Analysis." The applicant stated that the Lubricating Oil Analysis Program mitigates the effects of aging for plant components that are within the scope of license renewal and that are exposed to a lubricating oil environment. The program includes requirements to ensure the oil environment in the mechanical systems is maintained to the required quality (i.e., it maintains contaminants (water and particulates) within acceptable limits). The applicant further stated that the program requires management of the relevant conditions that could lead to the onset and propagation of loss of material due to crevice, galvanic, general, or pitting corrosion, or reduction in heat transfer due to fouling, through monitoring of the lubricating oil consistent with various manufacturers' recommendations and industry standards. Additionally, the applicant stated that the relevant parameters that are monitored—including particulate and water content, viscosity, and, under certain conditions, neutralization number and flash point—are indicative of conditions that could lead to age-related degradation of susceptible materials. Finally, the applicant stated that the Lubricating Oil Analysis Program is a mitigation program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M39. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M39, with the exception of the "acceptance criteria" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

By letter dated April 5, 2011, the staff issued RAI B.2.26-1, asking the applicant to provide information on how phase separated water is handled with respect to detection and prevention in lubricating oil systems. In a response dated May 5, 2011, the applicant stated that although the term "phase separated water" is not used in the Lubricating Oil Analysis Program or plant procedures, the amount of water contained in samples is determined through laboratory testing that would detect the presence of phase separated water due to the low limits allowed for water and contaminants contained in the lubricating oil, which are recorded in small units such as parts-per-million or weight-percent. Additionally, the applicant stated that the One-Time Inspection Program will supplement the Lubricating Oil Analysis Program and will be used to verify the effectiveness of the Lubricating Oil Analysis Program. The staff finds this acceptable because any phase separated water contained in a lubricating oil system will be able to be detected in small units such as parts-per-million or weight-percent by laboratory testing. The applicant indicated that corrective actions will be taken upon detection of phase separated water. Additionally, the One-Time Inspection Program will confirm the Lubricating Oil Analysis Program's effectiveness. The staff's concern described in RAI B.2.26-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.2.26-1, the staff finds that elements one through six of the applicant's Lubricating Oil Analysis Program are consistent with the corresponding program elements of GALL Report AMP XI.M39 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.26 summarizes operating experience related to the Lubricating Oil Analysis Program. The staff reviewed this information and interviewed the applicant's technical personnel to confirm that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. During the audit, the staff independently confirmed that the applicant adequately incorporated and evaluated operating experience related to this program.

The applicant stated that the Lubricating Oil Analysis Program is an ongoing program that effectively incorporates the best practices of the industry. The program incorporates expert recommendations and industry standards, which are used to establish quality requirements for lubricating oil. Additionally, the applicant stated that the program incorporates the results of operating experience from Davis-Besse and the industry to optimize testing parameters, sampling frequencies, acceptance criteria, and alarm levels, as required by the applicant's Condition Monitoring Program. The applicant further stated that the program has been, and continues to be, subject to periodic internal and external performance assessment to identify strengths and areas for improvement.

Additionally, the applicant conducted a self-assessment of the Lubricating Oil Analysis Program in early 2004. The overall assessment determined that the program was effective in implementing its stated goals. The assessment identified several areas for improvement, including enhancing procedures, consolidation of lubricating oils, addition of oil reservoir breathers and vents in certain locations, addition of sampling ports, and additional training. The applicant's Corrective Action Program was used to address the areas identified for improvement in the assessment. The applicant stated that a review of operating experience did not reveal a loss of component intended function for components exposed to lubricating oil that could be attributed to an inadequacy of the Lubricating Oil Analysis Program. The staff finds the performance of periodic internal and external assessments acceptable because it allows for identification of areas of improvement within the program and keeps the program informed of acceptable industry practices.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

<u>USAR Supplement</u>. LRA Section A.1.26 provides the USAR supplement for the Lubricating Oil Analysis Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.2-2. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its review of the applicant's Lubricating Oil Analysis Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the

intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 Nickel-Alloy Reactor Vessel Closure Head Nozzles Program

Summary of Technical Information in the Application. LRA Section B.2.29 describes the existing Nickel-Alloy Reactor Vessel Closure Head Nozzles Program as consistent with GALL Report AMP XI.M11A, “Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors (PWRs only).” The program manages cracking due to primary water stress corrosion cracking (PWSCC) for nickel-alloy components in the upper reactor pressure vessel (RPV) head. The program is consistent with the GALL Report recommendations for managing nickel-alloy materials to comply with the applicable NRC publications and industry guidelines.

Staff Evaluation. The staff reviewed the applicant’s claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL Report AMP XI.M11A. The staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.M11A. Based on its review, the staff finds that elements one through six of the applicant’s Nickel-Alloy Reactor Vessel Closure Head Nozzles Program are consistent, with one NRC required modification, with the corresponding program elements of GALL Report AMP XI.M11A and, therefore, are acceptable.

The applicant made one change from the requirements of GALL Report AMP XI.M11A. The AMP indicates that the requirements of 10 CFR 50.55a(g)(6)(ii)(D) and ASME Code Case N-729-1 will be implemented in lieu of the first revised NRC Order EA-03-009, dated February 20, 2010. This is consistent with the current regulatory requirements for upper head penetration inspection and, as discussed in the following paragraphs, is acceptable.

From February 20, 2004–December 31, 2008, the NRC regulatory requirement for RPV head inspections was contained under the first revised NRC Order EA-03-009 (Order). On August 6, 2004, the NRC, through a Staff Requirements Memorandum issued on SECY-04-115, “Rulemaking Plan to Incorporate First Revised Order EA-03-009 Requirements into 10 CFR 50.55a,” directed the staff to evaluate anticipated ASME Code RPV inspection requirements for incorporation into 10 CFR 50.55a. Thereafter, the staff participated in the development of ASME Code Case N-729. ASME Code Case N-729-1, Revision 1 to the original N-729, was developed as the ASME Code consensus standard for the long-term inspection program of RPV heads and their associated penetration nozzles. Effective by December 31, 2008, 10 CFR 50.55a(g)(6)(ii)(D) requires the use of ASME Code Case N-729-1, as conditioned by the NRC, in lieu of the Order to define the requirements for RV head inspections.

GALL Report, Volume 2, Revision 1, in which GALL Report AMP XI.M11A is provided by the NRC, was issued in September 2005, during the time period that upper head inspections were covered under the requirements of the Order. At that point, to achieve full consistency with the GALL Report, it was necessary for an applicant’s AMP to indicate compliance with the Order.

As the current regulatory requirements have changed from the Order to the those listed under 10 CFR 50.55a(g)(6)(ii)(D) for the Long-Term Inspection Program for upper RPV heads, the staff now deems consistency with the GALL Report to be achieved when the applicant's AMP demonstrates compliance with 10 CFR 50.55a(g)(6)(ii)(D).

Given the above basis for review of consistency between the applicant's AMP and GALL Report AMP, the staff reviewed the applicant's program to ensure compliance with the current long-term inspection requirements for the upper RPV head, as described in 10 CFR 50.55a(g)(6)(ii)(D). The applicant stated their program implemented ASME's Boiler and Pressure Vessel (B&PV) Code Case N-729-1, in accordance with 10 CFR 50.55a(g)(6)(ii)(D) and the NRC conditions of 10 CFR 50.55a(g)(6)(ii)(D)(2) through 10 CFR 50.55a(g)(6)(D)(6). The staff finds that the applicant's AMP is consistent with GALL Report AMP XI.M11A and, therefore, is acceptable

<u>Operating Experience</u>. LRA Section B.2.29 summarizes operating experience related to the applicant's Nickel-Alloy Reactor Vessel Closure Head Nozzles Program. The applicant has had significant operational experience in addressing PWSCC in the closure head penetration nozzles and welds. The applicant stated that in March 2002, significant degradation of the original Davis-Besse RV closure head was discovered. On March 13, 2002, NRC issued Confirmatory Action Letter (CAL) 3-02-001 to the applicant (ADAMS Accession No. ML020730225) confirming proposed actions by the applicant to address this issue. The NRC review and assessment of the applicant's corrective actions to address this issue are documented in Confirmatory Order EA-03-214, dated March 8, 2004 (ADAMS Accession No. ML040641171). NRC review and assessment of the applicant's corrective actions to address the Order are documented in a letter dated September 10, 2009, from the NRC to the applicant (ADAMS Accession No. ML092450747).

The applicant also stated that, in March 2010, examinations of the CRD mechanism nozzles and associated welds identified flaws on multiple nozzles. The applicant repaired each nozzle and agreed in CAL 3-10-001, dated June 23, 2010 (ADAMS Accession No. ML101740519), to voluntarily shutdown Davis-Besse no later than October 1, 2011, to replace the RPV head with one manufactured using materials more resistant to PWSCC. The replacement of the closure head with one that uses materials more resistant to PWSCC for the penetration nozzles and associated weld has been performed at over 35 other U.S. PWRs. No indications of PWSCC have been found in penetration nozzles or associated welds made with these materials. However, under the applicant's program, the new replacement head will continue to be inspected to ensure structural integrity of each penetration nozzle and associated weld. The staff finds that the applicant's replacement of the RV closure head with a head manufactured with penetration nozzles and associated welds with more PWSCC resistant materials and continued inspections under the applicant's program will provide reasonable assurance of public health and safety during the period of extended operation.

Based on its review of the application, the staff finds that, in conjunction with completing the commitments identified in CAL 3-10-001, the operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.29 provides the USAR supplement for the Nickel-Alloy Reactor Vessel Closure Head Nozzles Program. The staff reviewed this supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.1-2. The staff determined that the information in the supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Nickel-Alloy Reactor Vessel Closure Head Nozzles Program, and given the applicant's compliance with the current NRC's long-term inspection requirements for upper RPV heads, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.15 PWR Water Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.33 describes the existing PWR Water Chemistry Program as consistent with GALL Report AMP XI.M2, "Water Chemistry." The applicant stated that this program mitigates damage due to loss of material, cracking, and reduction of heat transfer of components exposed to treated water or steam in the primary, secondary, and auxiliary systems. The applicant also stated that it will manage aging using proper monitoring and control of water chemistry based on the EPRI water chemistry guidelines for the primary and secondary systems. The applicant further stated that this program will be credited in conjunction with the Nickel-Alloy Management Program, Inservice Inspection Program, Nickel-Alloy Reactor Vessel Closure Head Nozzles Program, PWR Reactor Vessel Internals (RVIs) Program, Steam Generator Tube Integrity Program, and Small Bore Class 1 Piping Inspection Program to manage the aging effects of various components. This program is supplemented by the One-Time Inspection Program to verify the effectiveness of the program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M2. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M2, with the exception of the "parameters monitored or inspected" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

GALL Report AMP XI.M2 recommends the use of EPRI PWR secondary water chemistry guidelines, Revision 7, to manage the water chemistry to the appropriate chemical levels. However, during its audit, the staff found that the applicant's basis document states that its PWR Water Chemistry Program is consistent with the EPRI PWR secondary water chemistry guidelines, Revision 5. The applicant's basis document further states that the program is periodically updated to the latest guidelines. The applicant's 2009 self-assessment of its secondary Water Chemistry Program states that the program should be revised following the review of the EPRI Revision 7 document. By letter dated April 20, 2011, the staff issued RAI B.2.33-1 requesting that the applicant clarify whether the applicant's program reflects the information in the updated EPRI PWR secondary water chemistry guidelines, Revision 7. The applicant was also asked to justify not updating the program to the newer document if the program incorporates the EPRI guidelines, Revision 5.

In its response dated May 24, 2011, the applicant stated the Davis-Besse water chemistry implementing procedure was revised to align with the latest revision in the EPRI PWR secondary water chemistry guidelines. The applicant stated that it revised the license renewal basis documents to address the updated secondary water chemistry procedures and Revision 7 of the EPRI PWR secondary water chemistry guidelines. The staff finds this acceptable because the applicant updated its water chemistry guidelines to the latest industrial standards consistent with the guidance in the GALL Report. The staff's concern described in RAI B.2.33-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.2.33-1, the staff finds that elements one through six of the applicant's PWR Water Chemistry Program are consistent with the corresponding program elements of GALL Report AMP XI.M2 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.33 summarizes operating experience related to the PWR Water Chemistry Program. The applicant stated that it identified an increase in reactor coolant lithium above the upper control band in December 2008. The applicant placed the delithiating demineralizer in service to restore the lithium to within control band limits. The applicant also stated that the SFP chemistry trends indicated that sulfates were out of specification. The SFP demineralizer was sluiced and charged with fresh resin to remedy the problem. The applicant further stated that in 2008, it was identified that the pressurizer dissolved oxygen control parameter for conditions prior to reaching 250 °Fahrenheit (F) (121 °Celsius (C)) was not consistent with the EPRI water chemistry guidelines. The procedure was modified to bring it in line with the EPRI water chemistry guidelines.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.33 provides the USAR supplement for the PWR Water Chemistry Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.1-2, 3.2-2, 3.3-2, and 3.4-2. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's PWR Water Chemistry Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.16 Selective Leaching Inspection

Summary of Technical Information in the Application. LRA Section B.2.36 describes the new Selective Leaching Inspection Program as consistent with GALL Report AMPXI.M33, "Selective Leaching of Materials." The applicant stated that the Selective Leaching Inspection Program will detect and characterize the conditions on internal and external surfaces of gray cast iron or copper-alloy (greater than15 percent zinc (Zn)) components that are exposed to moist air (including condensation), raw water, soil (buried), and treated water (including closed cycle cooling water and steam). The applicant also stated that this one-time inspection provides direct evidence—through visual inspection, material hardness measurement, or other appropriate examinations (such as chipping, scraping, or other mechanical means)—of whether, and to what extent, loss of material due to selective leaching has occurred. The applicant further stated that evidence of significant aging revealed by the Selective Leaching Inspection Program will be entered into the Corrective Action Program, and the resolution will include evaluation for expansion of the inspection sample size, locations, and frequency.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M33. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M33, with the exception of the "detection of aging effects" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of RAIs, as discussed below.

The "detection of aging effects" program element of GALL Report AMP XI.M33 recommends the inspections be conducted within the last 5 years prior to the period of extended operation. LRA Section B.2.36 states that the selective leaching inspection activities will be conducted just before the beginning of the period of extended operation. The description of the timing of the performance of selective leaching inspections in LRA Section B.2.36 does not ensure these inspections will be conducted within the last 5 years prior to the period of extended operation, as recommended by GALL Report AMP XI.M33. By letter dated April 20, 2011, the staff issued RAI B.2.36-1 requesting that the applicant clarify the planned timing of the selective leaching inspections relative to the period of extended operation and revise LRA Appendix A, USAR supplement, Section A.1.36 to reflect the fact that inspections required by this program will be conducted within the last 5 years prior to the period of extended operation.

In its response dated May 24, 2011, the applicant stated that the selective leaching inspections will be performed within the 5 years prior to entering the period of extended operation, and LRA Section A.1.36 was revised to state the timing of the inspection activities. The staff finds the applicant's response acceptable because the USAR supplement for the Selective Leaching

Inspection Program has been revised to include selective leaching inspections within 5 years prior to entering the period of extended operation, which is consistent with the recommendations in GALL Report AMP XI.M33. The staff's concern described in RAI B.2.36-1 is resolved.

The "detection of aging effects" program element of GALL Report AMP XI.M33 recommends that the inspections be performed on a representative sample of the system population focusing on the components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin, where 20 percent of the population (with a maximum sample size of 25) constitutes a representative sample size. LRA Section B.2.36 states that the selective leaching inspection activities include determination of the sample size based on an assessment of materials of fabrication, environment/conditions, time in service, and operating experience, as well as identification of the inspection locations in the susceptible system or component. It was not clear to the staff whether the extent and scope of the selective leaching inspection activities were consistent with GALL Report AMP XI.M33 recommendation. By letter dated April 20, 2011, the staff issued RAI B.2.36-2 requesting that the applicant do the following:

- revise LRA Section B.2.36 to indicate that a representative sample (e.g., 20 percent of the population with a maximum sample of 25) of the system population will be selected for inspection to demonstrate the absence of selective leaching
- describe the methodology used to ensure the representative sample focuses on the components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin
- update LRA Section B.2.36 to include a technical justification for the methodology and sample size used for selecting components, as an alternative to the first two requests

In its response dated May 24, 2011, the applicant revised LRA Section B.2.36 to state that the inspection includes a representative sample of the system population and focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. The applicant also stated that 20 percent of the population with a maximum sample size of 25 constitutes a representative sample size. The staff finds the applicant's response acceptable because the extent and scope of selective leaching inspections are consistent with the recommendations in GALL Report AMP XI.M33. The staff's concern described in RAI B.2.36-2 is resolved.

The "acceptance criteria" program element of GALL Report AMP XI.M33 recommends that the acceptance criteria are no visible evidence of selective leaching or no more than a 20 percent decrease in hardness. GALL Report AMP XI.M33 also recommends that for copper alloys with greater than 15 percent Zn, the acceptance criterion is no noticeable change in color from the normal yellow color to the reddish copper color. LRA Section B.2.36 states that the selective leaching inspection will use approved inspection techniques to identify selective leaching, and inspection results that identify selective leaching will be entered into the Corrective Action Program. It is not clear to the staff how GALL Report AMP XI.M33 recommendations in the "acceptance criteria" program element are addressed in the applicant's Selective Leaching Inspection Program. By letter dated June 20, 2011, the staff issued RAI B.2.36-4 requesting that the applicant (1) describe how GALL Report AMP XI.M33 recommendations in the "acceptance criteria" program element are addressed in the Selective Leaching Inspection Program, and (2) if the GALL Report recommended acceptance criteria are not included, state the basis and propose an alternate acceptance criterion capable of identifying the aging effects.

In its response dated July 22, 2011, the applicant revised LRA Section B.2.36 to state that the acceptance criteria are no visible evidence of selective leaching or no more than a 20 percent decrease in hardness. The applicant also stated that for copper alloys with greater than 15 percent Zn, the acceptance criteria includes no noticeable change in color from the normal yellow color to the reddish copper color. The staff finds the applicant's response acceptable because the acceptance criteria of the Selective Leaching Inspection Program are consistent with the recommendations in GALL Report AMP XI.M33. The staff's concern described in RAI B.2.36-4 is resolved.

Based on its audit and review of the applicant's response to RAIs B.2.36-1, B.2.36-2, and B.2.36-4, the staff finds that elements one through six of the applicant's Selective Leaching Inspection Program are consistent with the corresponding program elements of GALL Report AMP XI.M33 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.36 summarizes operating experience related to the Selective Leaching Inspection Program. The applicant stated that a review of its plant-specific operating experience did not identify any instances of loss of material due to selective leaching, graphitization, or dezincification for the in-scope components. The applicant also stated that two instances of aging for heat exchanger tubing that are not within the scope of license renewal were identified, and the findings were associated with stagnant and low-flow conditions when the heat exchanger was not in service.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff identified operating experience that could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

SRP-LR Section A.1.2.3.10 states that for new programs the applicant should commit to a review of future plant-specific and industry operating experience to confirm the program's effectiveness. LRA Section B.2.36 states that the Selective Leaching Inspection Program is a new program that will be consistent with GALL Report AMP XI.M33. However, the "operating experience" program element of the Selective Leaching Inspection Program does not include substantive operating experience examples confirming the effectiveness of the new program, and the applicant does not otherwise commit to a review of future plant-specific and industry operating experience to confirm the program's effectiveness. By letter dated April 20, 2011, the staff issued RAI B.2.36-3 requesting that the applicant revise its license renewal commitments to include a review of future plant-specific and industry operating experience to confirm the effectiveness of the new Selective Leaching Inspection Program.

In its response dated May 24, 2011, the applicant stated that the Selective Leaching Inspection Program includes one-time inspections of the sample set of components to confirm the absence of an aging effect and does not manage an aging effect. The applicant also stated that if plant-specific operating experience indicates the potential for selective leaching after completion of inspections, it will be addressed using the Corrective Action Program. The applicant further stated that a future confirmation of program effectiveness is not applicable to the Selective Leaching Inspection Program. However, the staff noted that even though the Selective

Leaching Inspection is a one-time inspection, the results of the inspections and industry operating experience should be reviewed to assess the effectiveness of the program at identifying selective leaching prior to loss of component intended function. If any deficiencies are identified, a review should be performed to determine whether the program should be enhanced or a new program should be developed. By letter dated July 27, 2011, the staff issued RAI B.2.36-5 requesting that the applicant state how future plant-specific and industry operating experience related to the selective leaching inspection will be reviewed to confirm the effectiveness of the program, evaluate the need for the program to be enhanced, or indicate a need to develop a new AMP.

In its response dated August 17, 2011, the applicant stated that, in its response to RAI B.1.4-1 dated June 24, 2011, the LRA was revised to add Commitment No. 43 to include future reviews of plant-specific and industry operating experience to the station operating experience process to confirm the effectiveness of the license renewal AMPs, evaluate the need for programs to be enhanced, or indicate a need to develop a new AMP. The staff finds the applicant's response acceptable because the applicant committed to a review of future plant-specific and industry operating experience to confirm the program's effectiveness, which is consistent with the SRP-LR recommendations for new programs. The staff's concerns described in RAIs B.2.36-3 and B.2.36-5 are resolved.

Based on its audit, review of the application, and review of the applicant's response to RAIs B.2.36-3 and B.2.36-5, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.36 provides the USAR supplement for the Selective Leaching Inspection Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the description for this type of program, as described in SRP-LR Tables 3.1-2, 3.2-2, and 3.3-2. The staff also noted that the applicant committed (Commitment No. 18) to implement the new Selective Leaching Inspection Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Selective Leaching Inspection Program, the staff finds all program elements are consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 Small Bore Class 1 Piping Inspection

Summary of Technical Information in the Application. LRA Section B.2.37 describes the new Small Bore Class 1 Piping Inspection Program as consistent with GALL Report AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." The applicant stated that this program detects and characterizes cracking of small bore ASME Code Class 1 piping less than 4 in. nominal pipe size (NPS), which includes pipe, fittings, and branch connections. The applicant further stated that the program consists of volumetric examination of a representative sample of small bore piping locations that are susceptible to cracking, which will include both socket welds and butt welds. In addition, the applicant stated that if a qualified non-destructive volumetric examination technique does not become available for socket welds, an opportunistic destructive examination will be conducted. The applicant also stated that the sample size and inspection locations will be based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M35. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMPXI.M35, with the exception of the "detection of aging effects" and "monitoring and trending" program elements. For these elements, the staff determined the need for additional information, which resulted in the issuance of RAIs.

GALL Report AMP XI.M35 states that it is applicable to systems that have not experienced cracking of Class 1 small-bore piping. It can also be applied to systems that have experienced cracking but have implemented design changes to effectively mitigate cracking. Systems that have experienced cracking and have not implemented design changes to mitigate it should have periodic inspections, as managed by a plant-specific AMP. The staff determined that the applicant has relevant operating experience of cracking of Class 1 small bore piping; thus, GALL Report AMP XI.M35 may not be applicable to this applicant.

By letter dated April 20, 2011, the staff issued RAI B.2.37-1 requesting that the applicant either provide justification that a one-time program, "Small Bore Class 1 Piping Inspection," is still applicable given the plant-specific operating experience or provides a plant-specific program to perform periodic inspections of Class 1 small-bore piping.

In its response dated May 24, 2011, the applicant provided a discussion of the two cases of plant-specific operating experience related to Class 1 small bore piping. In the first case, the applicant detected a crack in the pipe metal in the RV closure gasket leakage monitoring line during an inspection in 2002. The applicant performed an evaluation and determined that it was stress corrosion cracking (SCC) mainly caused by chloride residue left after water evaporated in the line. As part of its corrective actions, the applicant replaced the affected piping and changed the procedure to require draining and flushing of the line after use in order to eliminate chloride residue. The staff noted that the applicant performed design changes to mitigate the cause of failure and that there have not been similar failures since. In accordance with GALL Report AMP XI.M35, the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program is still applicable.

In the second case, the applicant also discussed an indication that was detected on a cold leg drain line nozzle-to-elbow weld from its UT examination during an outage inspection in 2006. To mitigate this indication, the applicant installed a full structural overlay on this weld and, in addition, preemptively installed full structural overlays on all similar drain line welds. The staff noted that the applicant's Inservice Inspection Program detected the indication and the applicant evaluated and mitigated the condition. The staff determined that this is not a case of failure of Class 1 small bore piping, but, instead, the case showed that the Inservice Inspection Program was effective in detecting and mitigating aging before leading to leakage.

Based on its review, the staff finds the applicant’s response to RAI B.2.37-1 acceptable because the applicant experienced only one case of Class 1 small bore piping failure and has performed design changes, which have effectively mitigated the causal factors for this failure. The applicant has not experienced failures since the implementation of the design changes. The staff’s concern described in RAI B.2.37-1 is resolved.

GALL Report AMP XI.M35 states that the one-time inspection should be completed within 6 years prior to the period of extended operation. However, the applicant stated in LRA Section B.2.37 that the program will be implemented “prior to the period of extended operation.” In addition, Commitment No. 19 states that the program will be implemented on April 22, 2017. The staff noted this inconsistency with GALL Report AMP XI.M35; therefore, by letter dated April 20, 2011, the staff issued RAI B.2.37-2 requesting that the applicant clarify the program implementation schedule and provide justification if the schedule is not consistent with the recommendation in GALL Report AMP XI.M35.

In its response dated May 24, 2011, the applicant modified LRA Section B.2.37 and the associated Commitment No. 19 to state that the program will be implemented “within the six year period prior to entering the period of extended operation.”

Based on its review, the staff finds the applicant’s response to RAI B.2.37-2 acceptable because the applicant’s program will be implemented within the 6-year period prior to entering the period of extended operation, which is consistent with GALL Report AMP XI.M35. The staff’s concern described in RAI B.2.37-2 is resolved.

GALL Report AMP XI.M35 states that, if the applicant has experienced cracking in its Class 1 small-bore piping and has incorporated design changes to mitigate it, the inspections performed under this program should include 10 percent of the weld population or a maximum of 25 welds of each weld type (e.g., full penetration or socket weld) using a methodology to select the most susceptible and risk-significant welds. During its audit, the staff found that the applicant does not have specific information regarding the subject small-bore piping weld population or its inspection sampling size. This information is necessary for the staff to evaluate if the applicant’s inspection sampling is adequate and is consistent with GALL Report AMP XI.M35.

By letter dated April 20, 2011, the staff issued RAI B.2.37-3 requesting that the applicant clarify the total population of Class 1 small-bore butt and socket welds so that the sample sizes as a percentage of welds of each type can be determined. In addition, the applicant was asked to justify the sampling adequacy if the percentage is less than the sampling guideline, as described in GALL Report AMP XI.M35.

In its response dated May 24, 2011, the applicant stated that a statistically significant sample size will be volumetrically examined. The applicant indicated that there are approximately 179 Class 1 small-bore full penetration welds and 437 Class 1 small-bore socket welds. The inspection sampling will consist of 10 percent of the weld population or a maximum of 25 welds of each weld type, which will be selected from the most susceptible and risk-significant welds. The staff finds that the number of welds, both butt welds and socket welds, to be inspected is consistent with the sampling guidance and recommendations in GALL Report AMP XI.M35 and is, therefore, acceptable. The applicant also indicated that, for socket weld examination, it has an option of performing destructive examination in lieu of volumetric examination on a two-for-one basis. Based on the staff's sampling guidance, an applicant may take credit for each weld destructively examined as being equivalent to having volumetrically examined two welds because more information can be obtained from a destructive examination than from NDE; therefore, the staff finds the applicant's option to perform destructive examination in lieu of volumetric examination on a two-for-one basis acceptable and consistent with GALL Report AMP XI.M35.

Based on its review, as described above, the staff finds the applicant's response to RAI B.2.37-3 acceptable because its sampling methodology and inspection methods are consistent with the recommendations in GALL Report AMP XI.M35. The staff's concern described in RAI B.2.37-3 is resolved.

Based on its audit, and review of the applicant's responses to RAIs B.2.37-1, B.2.37-2 and B.2.37-3, the staff finds that elements one through six of the applicant's Small Bore Class 1 Piping Inspection Program are consistent with the corresponding program elements of GALL Report AMP XI.M35 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.37 summarizes operating experience related to the Small Bore Class 1 Piping Inspection Program. The applicant indicated that this program is based on relevant plant and industry operating experience. The applicant further provided some plant-specific operating experience including two instances related to Class 1 small-bore piping, which were identified at the site. Further detail related to these incidences and the staff's review is documented above in the discussion related to RAI B.2.37-1.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program will result in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.37 provides the USAR supplement for the Small Bore Class 1 Piping Inspection Program. The staff reviewed this USAR supplement description of the program against the recommended description for this type of program, as described in SRP-LR Table 3.0-1. The staff noted that the applicant committed (Commitment No. 19, as amended by letter dated May 24, 2011) to implement the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program within 6 years prior to entering the period of extended operation. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Small Bore Class 1 Piping Inspection Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.18 Steam Generator Tube Integrity Program

Summary of Technical Information in the Application. LRA Section B.2.38 describes the existing Steam Generator Tube Integrity Program as consistent with GALL Report AMP XI.M19, "Steam Generator Tube Integrity." The applicant stated that the Steam Generator Tube Integrity Program is credited for aging management of cracking, denting, loss of material, and reduction in heat transfer of the steam generator (SG) tubes as well as cracking of tube plugs, tube sleeves, and tube support plates. The applicant further stated that the Steam Generator Tube Integrity Program is performed as part of the overall Steam Generator Management Program, the program is based on TS requirements, and the program is implemented in accordance with NEI 97-06, "Steam Generator Program Guidelines." The applicant further stated that the Steam Generator Tube Integrity Program also includes secondary-side examinations to assist in verification of tube integrity and the condition of the tube support plates. Additionally, the applicant stated that the Steam Generator Tube Integrity Program is a combination condition monitoring and mitigation program.

During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M19. As discussed in the audit report, the staff was unable to confirm that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M19. For each element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

By letter dated April 5, 2011, the staff issued RAI B.2.38-1 requesting that the applicant confirm that the Steam Generator Tube Integrity Program addressed the potential inconsistencies between NEI 97-06, Revision 2, and the standard SG TS, as described in TSTF-449 adopted by the applicant. In a response dated May 5, 2011, the applicant stated that the Steam Generator Tube Integrity Program is based on the TS requirements and that the Steam Generator Program is implemented in accordance with NEI 97-06 "Steam Generator Program Guidelines," Revision 2; however, NEI 97-06, Revision 3, which eliminates any identified conflicts with the standard SG TS and its incorporated reference documents, were implemented on its required implementation date of September 30, 2011. The staff finds this acceptable because implementation of NEI 97-06, Revision 3, will happen prior to the period of extended operation. The staff's concern described in RAI B.2.38-1 is resolved.

On October 21, 2011, as part of its response to RAI 3.1.2.2.16-1, the applicant revised the Steam Generator Tube Integrity Program to include managing cracking due to PWSCC in tube-to-tubesheet welds (Alloy 600). In its review of the applicant's response, the staff found a need to clarify whether the "Alloy 690 TT material," which refers to a potential material for future SG welds, means Alloy 690 TT tubes with Alloy 690 type weld material (e.g., Alloy 52). The staff also noted that it is not clear whether Section XI of the ASME Code has acceptance criteria for these SG tube-to-tubesheet welds. In addition, the staff found a need to further clarify whether the EVT-1 inspection is capable of detecting cracking in the tube-to-tubesheet weld. The staff also needed clarification on why a sample size of 25 is adequate to monitor for the cracking of the SG tube-to-tubesheet welds. Therefore, by letter dated November 8, 2011, the staff issued RAI 3.1.2.2.16-2 requesting the applicant to address the staff concerns mentioned above.

In its response dated November 23, 2011, the applicant stated that ASME Code Section XI does not have acceptance criteria for the SG tube-to-tubesheet welds and that the acceptance criteria will be revised to consist of no indication of cracking or relevant conditions of degradation. Additionally, the applicant stated that in lieu of providing information to demonstrate that the EVT-1 inspection is capable of detecting cracking in the tube-to-tubesheet welds, the inspection method for the existing SG tube-to-tubesheet welds will be revised to consist of a gross visual inspection of the welds coupled with eddy-current inspection (i.e., bobbin coil or rotating coil examinations) of the tubes. The gross visual inspection of the tube-to-tubesheet welds coupled with eddy-current inspection of the tubes will confirm the structural integrity of the tube-to-tubesheet joint. The applicant also stated that in lieu of providing justification that the sample size of 25 SG tube-to-tubesheet welds is adequate to monitor for PWSCC, the sample size for the existing SG tube-to-tubesheet welds will be revised such that a gross visual inspection of the SG tube-to-tubesheet welds will be scheduled concurrent with eddy-current inspections of the SG tubes.

In its review of the applicant's response to RAI 3.1.2.2.16-2, the staff noted that it was not clear whether the gross visual inspection of the tube-to-tubesheet welds will include the welds on the hot leg, cold leg, or both legs. Additionally, the staff found that more clarification was needed on the extent and method of the visual inspection addressed in the applicant's response. Therefore, by letter dated November 27, 2011, the staff issued RAI 3.1.2.2.16-3 requesting that the applicant clarify the location, type, scope, frequency and acceptance criteria of the proposed visual examination to be included in the Steam Generator Tube Integrity Program. In addition, the staff requested that the applicant describe how eddy-current testing will be used in conjunction with the proposed visual examination to manage for PWSCC in the tube-to-tubesheet welds.

In its response dated, January 13, 2012, the applicant stated that the Steam Generator Tube Integrity Program will include a gross visual inspection of the SG tube-to-tubesheet welds coupled with eddy-current inspection (i.e., bobbin coil or rotating coil examinations) of the tubes to monitor for cracking and degradation of the tube-to-tubesheet welds (Alloy 600). The applicant stated that the gross visual inspections will be scheduled concurrent with eddy-current inspection of the SG tubes that are scheduled in accordance with the applicant's TS 5.5.8. The applicant further stated that at a minimum, 100 percent of the tubes are inspected at sequential periods of 60 effective full power months, and therefore, at a minimum, 100 percent of the tube-to-tubesheet welds (includes both the hot leg and cold leg welds) are inspected at sequential periods of 60 effective full power months.

The applicant stated that the gross visual inspection of the tube-to-tubesheet welds will consist of a remote-visual examination using a manipulator camera to obtain a straight-on view of the weld with a visual acuity sufficient to detect evidence of degradation. These visual examinations will be performed by personnel who are qualified for ASME code visual examination (i.e., are certified VT-1 or VT-3 examiners) and are knowledgeable in the type of tube-to-tubesheet welds being examined (i.e., fillet welds).

The applicant also stated that the acceptance criteria for the gross visual inspections and the eddy-current inspections consist of no indication of cracking or relevant conditions of degradation. Finally, the applicant stated that should the SG be replaced in the future with a design such that the tubes, tubesheet cladding and tube-to-tubesheet welds are fabricated of Alloy 690 material, only the PWR Water Chemistry Program will manage cracking due to PWSCC of the tube-to-tubesheet welds and the gross visual inspection will no longer be required.

The staff has reviewed the applicant's proposal to manage the aging effects of SCC in the tube-to-tubesheet Alloy 600 welds through visual and eddy-current examination methods (via the Steam Generator Tube Integrity Program) and through the PWR Water Chemistry Program. The staff recognizes that neither the visual or eddy-current inspection methods have been formally qualified for the detection of cracking in the welds. Nonetheless, these inspection methods should provide indication of widespread weld degradation. The staff's review of the proposed aging management program considered the capabilities/limitations of the tube-to-tubesheet weld inspection methods and the following factors:

(1) The weld is considered a seal weld. In addition to the weld, the interference fit between the tube and the tubesheet (i.e., from mechanical rolling) provides assurance of the structural and leakage integrity of the joint. As a result, minor degradation of the weld may not compromise the integrity of the joint.

(2) Tubes with extensive degradation in the joint area have been repaired by installing additional rolled areas further into the tubesheet from the primary face of the tubesheet (i.e., inboard of the original rolls). These re-rolls establish a new pressure boundary which reduces the importance of the original joint (tube-to-tubesheet weld and the original roll expansion).

(3) Significant degradation propagating out of the weld and into the interference fit region of the tube joint is detectable by eddy-current examination methods (i.e., there are qualified methods for detecting this form of degradation in this region of the tubing).

(4) Defects in the roll joint will result in tube plugging or repair and the importance of any degradation in the tube-to-tubesheet weld will be reduced.

(5) There has been no evidence of significant operating issues with cracking of the tube-to-tubesheet welds at operating plants in the U.S.

(6) The service life of the original Davis-Besse SGs (with mill annealed Alloy 600 tubes) will most likely be limited due to degradation in other regions of the tubes. This degradation will most likely result in replacement of the SGs at Davis-Besse as it has for the vast majority of SGs with mill annealed Alloy 600 tubes. This limits the potential for cracking to occur in the weld and may reduce the significance of any cracking that may occur.

(7) A 360 degree circumferential crack in the weld could potentially result in the tube slipping within the tubesheet during design basis events. Tube pullout from the tubesheet is not expected. Tube slippage may result in some leakage, but the leakage would be expected to be limited given the interference fit between the tube and the tubesheet.

As a result of the above, the staff concludes that the aging effects of PWSCC in the tube-to-tubesheet welds in the original SGs can be effectively managed for the remaining service-life of the SGs. In addition, there has been no PWSCC identified in tube-to-tubesheet welds fabricated of Alloy 690 material in the U.S. operating fleet; therefore, the staff also concludes that should the applicant's SGs be replaced in the future with a design such that the tubes, tubesheet cladding and tube-to-tubesheet welds are fabricated of Alloy 690 material, a gross visual examination will no longer be required for managing cracking due to PWSCC of the tube-to-tubesheet welds.

Based on its audit and review of the applicant's response to RAI B.2.38-1, RAI 3.1.2.2.16-1, RAI 3.1.2.2.16-2, and RAI 3.1.2.216-3, the staff finds that elements one through six of the applicant's Steam Generator Tube Integrity Program are consistent with the corresponding program elements of GALL Report AMP XI.M19 and, therefore, are acceptable.

<u>Operating Experience</u>. LRA Section B.2.38 summarizes operating experience related to the Steam Generator Tube Integrity Program. The staff reviewed this information and interviewed the applicant's technical personnel to confirm that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. During the audit, the staff independently confirmed that the applicant adequately incorporated and evaluated operating experience related to this program.

The applicant stated that during each RFO, SG degradation assessments are performed in accordance with the provisions of NEI 97-06 and the EPRI PWR SG examination guidelines. These industry guidelines are based in part on operating experience and inspection results from other operating PWRs. Degradation assessment topics include SG tube degradation mechanisms, inspection and expansion requirements, tube repair criteria, structural limits, guidelines for testing, and chemical cleaning provisions. The applicant identified several instances of tube degradation through eddy current examination. The applicant stated that causes were determined to be mechanical equipment degradation, which is primarily a function of time in operation, temperature of operation, and chemistry conditions. Additional causes were predicted to be PWSCC, SCC or intergranular attack (IGA), denting, and outer diameter SCC. The applicant further stated that repairs were made through the Corrective Action Program.

The applicant stated that as a result of the Cycle 15 RFO inspections, 46 SG tubes were plugged in OTSG 2-A, bringing the total for that SG to 625 tubes plugged (4 percent). Additionally, 35 SG tubes were plugged in OTSG 1-B, bringing the total for that SG to 279 tubes plugged (1.8 percent). The applicant stated that, as with all previous inspections, the condition of the SGs (with the degraded tubes plugged) met industry and regulatory structural and leakage integrity guidance and were expected to meet these criteria following the outage inspection. The applicant further stated that SG inspection results are addressed in the ISI summary reports that are submitted to the NRC following each outage.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. The applicant's operating experience demonstrates that plant-specific and industry acceptable practices are implemented and that the program is able to manage the aging effects of cracking, denting, loss of material, and reduction in heat transfer of the SG tubes as well as cracking of tube plugs, tube sleeves, and tube support plates. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.38 provides the USAR supplement for the Steam Generator Tube Integrity Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.1-2. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Steam Generator Tube Integrity Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant stated that the following AMPs are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- Aboveground Steel Tanks Inspection Program
- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- Closed Cooling Water Chemistry Program
- External Surfaces Monitoring Program
- Fatigue Monitoring Program
- Fire Protection Program
- Fire Water Program
- Fuel Oil Chemistry Program
- Masonry Wall Inspection Program
- One-Time Inspection Program
- Open-Cycle Cooling Water Program
- Reactor Head Closure Studs Program
- RV Surveillance Program
- Structures Monitoring Program
- Water Control Structures Inspection Program

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 if 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 Aboveground Steel Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.2 describes the existing Aboveground Steel Tanks Inspection Program as consistent, with an enhancement, with GALL Report AMP XI.M29, “Aboveground Steel Tanks.” The applicant stated that the Aboveground Steel Tanks Program manages the effects of corrosion on the external surfaces and inaccessible locations of the steel fire water storage tank and diesel oil storage tank. The applicant also stated that the program includes periodic visual inspections for loss of material and a volumetric examination of the tank bottoms. The applicant further stated that the frequency of tank bottom volumetric inspection will be based on the findings of an inspection performed prior to the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL Report AMP XI.M29. As discussed in the audit report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL Report AMP XI.M29, with the exception of the “preventive actions” program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The “preventive actions” program element of GALL Report AMP XI.M29 states that sealant or caulking at the external interface between the tank and concrete or earthen foundation mitigates corrosion of the bottom surface of the tank by minimizing the amount of water and moisture penetrating the interface, which would lead to corrosion of the bottom surface. LRA Section B.2.2 did not state that sealant or caulking was used at the external interface between the tank and concrete or earthen foundation. It was not clear to the staff whether the fire water storage tank, diesel fuel oil storage tanks, and borated water storage tank (BWST) have sealant or caulking installed at the external interface between the tank and concrete or earthen foundation. It was also not clear to the staff how aging of the bottom surface of the tanks will be effectively managed if sealant or caulking was not installed at the base. By letter dated April 20, 2011, the staff issued RAI B.2.2-3 requesting that the applicant clarify whether the fire water storage, diesel fuel oil storage, and BWSTs have sealant or caulking installed at the external interface between the tank and concrete or earthen foundation. If these tanks do not have sealant or caulking, the staff asked the applicant to revise LRA Section B.2.2 to state and justify this as an exception to GALL Report AMP XI.M29. If the tanks do have sealant or caulking, the staff asked the applicant to state how their aging effects will be managed.

In its response dated May 24, 2011, the applicant stated the following:

> The fire water storage tank does not have sealant or caulking at the interface edge between the tank and the foundation. The fire water storage tank rests on an oiled sand pad on top of granular fill, and the tank bottom surface is raised 6 inches from the finished grade to preclude water accumulation around the tank bottom.
>
> The diesel fuel oil storage tank has a sealant between the tank and the foundation, and the tank bottom surface is raised approximately 5 inches above the finished grade to preclude water accumulation around the tank bottom.

> The BWST has a sealant between the tank and the foundation, and the tank bottom surface is raised approximately one foot from the finished grade to preclude water accumulation around the tank bottom.

The applicant stated that LRA Section B.2.2 was revised to include an exception to GALL Report AMP XI.M29 that the fire water storage tank does not have sealant or caulking at the interface edge between the tank and the foundation. The applicant also stated that the basis for the acceptability of this exception is based on the tank resting on an oiled sand pad on top of granular fill, which slopes down from the tank center to the outside edge due to the tank bottom surface being raised 6 in. from the finished design. The applicant further stated that this configuration precludes water accumulation around the tank bottom, and, therefore, no sealant or caulking inspection is required for the fire water storage tank. The applicant stated that the Aboveground Steel Tanks Inspection Program was revised to inspect for degradation of the sealant on the diesel fuel oil storage, and BWSTs which will be managed by periodic system walkdowns to confirm that the sealant is intact. The applicant further stated that the program will also include volumetric wall-thickness examinations of the tank bottoms.

By letter dated December 20, 2012, the applicant supplemented its response to RAI B.2.2-3. The applicant stated that an inspection of the diesel oil storage tank revealed that sealant was not installed around the interface edge between the tank and the foundation. The applicant stated that the condition was entered into the Corrective Action Program and that the condition was corrected when the sealant was installed on December 13, 2012. The applicant also stated that UT was conducted to measure the thickness of the bottom of the tank. Nine runs of approximately 20 ft each using a star pattern were conducted with continuous measurements totaling approximately 345,000 data points. The applicant stated that the nominal thickness of the tank bottom is 0.250 inches and the average minimum thickness was 0.247 inches with a minimum reading of 0.244 inches. The applicant concluded that based on these readings, the design criterion of the tank is met. The applicant further stated that according to the vendor conclusion the remaining life of the tank bottom is greater than 20 years.

The staff finds the applicant's original and supplemental responses acceptable for the following reasons:

- It provided sufficient information about sealant or caulking installed at the external interface between the in-scope tanks and the foundations for the staff to evaluate consistency with GALL Report AMP XI.M 29.
- The Aboveground Steel Tanks Inspection Program has been revised to state an exception to GALL Report AMP XI.M29. The staff finds this acceptable because, based on the fire water storage tank's configuration, water should not accumulate under the tank's foundation and at least one volumetric inspection of the tank bottom's thickness will be conducted within 5 years after entering the period of extended operation to confirm that aging is not occurring.
- Conducting periodic system walkdowns to confirm that the sealant is intact on the diesel fuel oil storage tanks and BWSTs is consistent with GALL Report AMP XI.M29.
- The non-conforming condition was corrected when the sealant was installed on the diesel oil storage tank, tank bottom thickness measurements demonstrated that the design criterion was met, and in accordance with the response to RAI B.2.2-1, bottom thickness measurements, capable of detecting any degradation will be conducted again within 5 years after entering the period of extended operation.

The staff's concern described in RAI B.2.2-3 is resolved.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the enhancement to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement 1. LRA Section B.2.2 states an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. The applicant stated that the Aboveground Steel Tanks Program will be enhanced to include the performance of a volumetric examination of the tank bottoms prior to the period of extended operation to detect evidence of loss of material due to crevice, general, or pitting corrosion, or to confirm a lack thereof. The applicant also stated that the enhancement will include establishing the examination technique, the inspection locations, and the acceptance criteria for the examination of the tank bottoms.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M29 and noted that the "detection of aging effects" program element of GALL Report AMP XI.M29 recommends that potential corrosion of tank bottoms be determined by conducting thickness measurements of in-scope tank bottoms. LRA Section B.2.2 states that the volumetric examination of the tank bottoms will be conducted prior to the period of extended operation and that the frequency of tank bottom volumetric inspections will be based on the findings of the inspection performed prior to the period of extended operation. The "detection of aging effects" program element of GALL Report AMP XI.M29, states that UT testing thickness measurements should be conducted whenever the tank is drained and at least once within 5 years of entering the period of extended operation to ensure that loss of material is not occurring and that the component's intended function is maintained. It is not clear to the staff what minimum number of tank bottom thickness measurements will be conducted during the period of extended operation regardless of the findings of the inspection stated in LRA Section B.2.2. By letter dated April 20, 2011, the staff issued RAI B.2.2-1 requesting that the applicant state the minimum number of times each in-scope tank's bottom will be inspected for thickness during the period of extended operation.

In its response dated May 24, 2011, the applicant stated that each in-scope tank's bottom will be inspected for thickness at least once within 5 years after entering the period of extended operation. The applicant also stated that a set inspection frequency may be established based on the results of the inspection. The applicant enhanced LRA Sections A.1.2 and B.2.2, and LRA Table A-1, Commitment No. 1 for the Aboveground Steel Tanks Inspection Program to include a requirement to conduct volumetric examinations of tank bottoms at least once for each tank within 5 years after entering the period of extended operation. The applicant stated that additional opportunistic tank bottom inspections will be performed whenever the tanks are drained.

The staff finds the applicant's response and the enhancement acceptable because the frequency of thickness measurements of the tank bottoms and its implementation prior to the period of extended operation will make the program consistent with the recommendations in GALL Report AMP XI.M29. The staff's concern described in RAI B.2.2-1 is resolved.

Based on its audit and review of the applicant's response to RAIs B.2.2-1 and B.2.2-3, the staff finds that elements one through six of the applicant's Aboveground Steel Tanks Inspection

Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL Report AMP XI.M29 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.2 summarizes operating experience related to the Aboveground Steel Tanks Inspection Program. The applicant stated that its system walkdown activities have identified numerous cases of paint degradation, including flaking, blistering, peeling, and chipping throughout the plant. The applicant stated that none of those cases resulted in corrosion of the tank's exterior surface, which confirms that the visual inspections are capable of detecting the condition of painted surfaces. The applicant stated that an inspection of the exterior of the diesel oil storage tank in 2002 revealed rust and corrosion at the base flange of the tank and corroded bolts at the lower access plate at the base of the tank. The applicant also stated that a work order was issued to address painting and preservation of the corroded areas of the tank. The applicant further stated that an inspection of the exterior of the tank in 2008 revealed minor paint scratches and chipping with no corrosion, and a work order was issued to address cleaning and repainting of the affected areas.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience that could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

As stated above, LRA Section B.2.2 states that an inspection of the exterior of the diesel oil storage tank in 2002 revealed rust and corrosion at the base flange of the tank and corroded bolts at the lower access plate at the base of the tank. The applicant did not state the cause of corrosion on the external surface of the tank. By letter dated April 20, 2011, the staff issued RAI B.2.2-4 requesting that the applicant (1) state the cause(s) for the external tank surface corrosion that occurred in 2002 associated with the diesel oil storage tank, (2) explain what extent of condition review was conducted, and (3) describe how this plant-specific operating experience was incorporated into the Aboveground Steel Tanks Inspection Program.

In its response dated May 24, 2011, the applicant stated that the degradation was identified during system health readiness walkdowns, and the apparent cause of the corrosion at the base flange and the lower access plate of the diesel oil storage tank were due to degradation of the protective coatings. The applicant also stated that the condition report determined no operability concern, and no specific extent-of-condition review was necessary for the identified tank corrosion. The applicant further stated that the corroded area was cleaned, and the tank was repainted through a work order. The applicant stated that the Aboveground Steel Tanks Inspection Program is effective in identifying surface corrosion and ensuring corrective action prior to loss of intended function, and the program uses performance monitoring and evaluation of operating experience to identify adverse trends and adjust inspection frequency.

The staff finds the applicant's response acceptable because it provided the cause for the external surface corrosion of the diesel oil storage tank. Additionally, the degradation was identified during system health readiness walkdowns, which are used to implement the external visual inspections of the tanks. Performance monitoring and operating experience will be used to identify adverse trends, and the degradation was evaluated using the Corrective Action Program, which is consistent with the recommendations in GALL Report AMP XI.M29. The staff's concern described in RAI B.2.2-4 is resolved.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.2 provides the USAR supplement for the Aboveground Steel Tanks Inspection Program. The staff reviewed this USAR supplement description of the program against the recommended description for this type of program, as described in SRP-LR Tables 3.3-2 and 3.4-2. The staff found that the USAR supplement does not state that the program includes (1) preventive measures to mitigate corrosion by protecting the external surface of steel components per standard industry practice, (2) sealant or caulking at the interface of concrete and component, and (3) verification of the effectiveness of the program by measuring the thickness of the tank bottoms to ensure that significant degradation is not occurring. The licensing basis for the period of extended operation may not be adequate if the applicant does not incorporate this information in its USAR supplement. By letter dated June 20, 2011, the staff issued RAI A.1.2-1 requesting that the applicant amend the USAR supplement to be consistent with SRP-LR Tables 3.3-2 and 3.4-2.

In its response dated July 22, 2011, the applicant stated that LRA Section A.1.2 is revised to include (1) preventive measures to mitigate corrosion by protecting the external surface of steel components per standard industry practice and with sealant or caulking at the interface of concrete and component, as applicable, and (2) a statement that the tank bottom inspections will verify the effectiveness of the program by measuring the thickness of the tank bottoms to ensure that significant degradation is not occurring.

The staff finds the applicant's response and USAR supplement acceptable because the amended USAR supplement includes the requested statements that are consistent with the recommendations in SRP-LR Tables 3.3-2 and 3.4-2. The staff's concern described in RAI A.1.2-1 is resolved. The staff also noted that the applicant committed (Commitment No. 1) to enhance the existing Aboveground Steel Tanks Inspection Program for managing aging of applicable components during the period of extended operation.

The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Aboveground Steel Tanks Inspection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 1 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Bolting Integrity Program

Summary of Technical Information in the Application. LRA Section B.2.4 describes the existing Bolting Integrity Program as consistent with exceptions with GALL Report AMP XI.M18, "Bolting Integrity." The applicant stated that the Bolting Integrity Program manages aging effects for bolting and bolting components of subject mechanical components and structural connections. The applicant also stated that the Bolting Integrity Program is a condition monitoring program that includes periodic inspections of bolted closures and connections for aging effects such as leakage, loss of material due to corrosion, loss of preload, and cracking due to SCC. The applicant further stated that the Bolting Integrity Program includes preventive measures to minimize loss of preload and cracking. In addition, the applicant indicated that the inspections are implemented through other AMPs such as the Inservice Inspection Program; Inservice Inspection (ISI) Program—IWE; Inservice Inspection (ISI) Program—IWF; Structures Monitoring Program; and External Surfaces Monitoring Program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M18. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M18, with the exception of the "preventive actions," "detection of aging effects," and "parameters monitored or inspected" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

GALL Report AMP XI.M18 recommends preventive actions and inspections for managing bolting within the scope of license renewal. The GALL Report AMP also indicates that high strength structural bolting (actual yield strength greater than 150 kips per square inch (ksi)) should be monitored for SCC. The staff noted, during its review that the applicant's Bolting Integrity Program, inspection of structural bolting is accomplished through the Inservice Inspection (ISI)—IWE and Inservice Inspection (ISI)—IWF Programs or the Structures Monitoring Program. The applicant's Inservice Inspection (ISI)—IWF and Structures Monitoring Programs basis documents do not provide guidance for aging effects related to bolting, associated preventive actions, or recommended inspections. In addition, the applicant does not reference aging effects or aging management of high strength bolting (actual yield strength greater than or equal to 150 ksi) that are greater than 1 inch nominal diameter in the LRA or Bolting Integrity Program basis documents. It is unclear to the staff as to how the aging effects (specifically SCC) will be managed.

By letter dated April 20, 2011, the staff issued RAI B.2.4-1 requesting that the applicant describe how GALL Report AMP XI.M18 recommendations in the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements are addressed for bolting in the Inservice Inspection (ISI) Program—IWE, Inservice Inspection (ISI) Program—IWF, and Structures Monitoring Program. The applicant was also asked to describe how loss of preload is managed and how susceptible bolting (actual measured yield strength greater than or equal to 150 ksi and greater than 1 inch nominal diameter) is managed for SCC, including the specific inspection technique and AMP credited. In its response dated May 24, 2011, the applicant stated that the Bolting Integrity Program includes periodic visual inspections of bolting for indications of degradation such as leakage, loss of material, loss of preload, and cracking implemented through the Inservice Inspection, Inservice Inspection (ISI)—IWE, Inservice

Inspection (ISI)—IWF, Structures Monitoring, and External Surfaces Monitoring programs. The applicant also clarified that the Bolting Integrity Program addresses the GALL Report AMP XI.M18 recommendations for the "preventive actions" and "parameters monitored or inspected" program elements through the use of industry guidelines and manufacturer or vendor recommendations for providing the selection of bolting materials, use of proper lubricants and sealants, and proper torquing and assembly of bolted closures. The applicant also described the specific inspection techniques used to manage the AERMs.

For the "detection of aging effects" program element, the applicant stated that visual inspections will be performed on structural bolting, including component support bolting both inside and outside containment through the Inservice Inspection (ISI)—IWE, Inservice Inspection (ISI)—IWF, and Structures Monitoring Programs. The applicant also stated that visual inspections shall also be performed on containment bolting through the Inservice Inspection (ISI) Program—IWE. The applicant further stated that volumetric or surface examinations are not currently conducted to detect SCC on bolting since no instances of failed bolting or bolted connections due to SCC had occurred at Davis-Besse. The applicant stated that visual examinations of structural components will detect corrosion or a corrosive environment that could lead to SCC. The applicant also stated that if degradation of the bolting or bolt components is found, then a closer inspection will be performed through another technique, selected on the basis of the application or the applicable code. The applicant indicated that LRA Table 3.5.2-13 is revised to include a plant-specific note to clarify that the Bolting Integrity Program includes the Inservice Inspection (ISI) Program—IWE, Inservice Inspection (ISI) Program—IWF, and Structures Monitoring Program for the management of structural bolting.

The staff finds the applicant's response acceptable, in part, for the following reasons:

- The applicant is implementing visual inspections needed to manage loss of preload, loss of material, and cracking. Visual inspections are consistent with the "parameters monitored or inspected" and "detection of aging effects" recommendations in GALL Report AMP XI.M18.
- GALL Report AMPs XI.M18 and XI.S3, "ASME Section XI, Subsection IWF," "detection of aging effects" program elements state that the volumetric examination of high strength structural bolting may be waived based on adequate plant-specific justification.
- The volumetric examination waiver is justified on the basis that the applicant's plant-specific operating experience has not identified this aging effect and that any future identification will be possible through its existing Bolting Integrity Program and will be managed subsequently.
- The use of industry guidelines and manufacturer or vendor recommendations for providing the selection of bolting materials, use of proper lubricants and sealants, and proper torquing and assembly of bolted closures is consistent with the preventive action recommendations in GALL Report AMPs XI.M18 and XI.S3.

Although the volumetric examination waiver is justified based on past plant-specific operating experience, it was not clear to the staff what parameters or criteria would be used to detect a corrosive environment that could lead to future SCC of high-strength bolting. Subsequent to a conference call on October 16, 2012, where the staff requested clarification on the use of high-strength bolting, the applicant amended its response to RAI B.2.4-1 by letter dated November 2, 2012, stating that ASTM A36, A276, A307, A325, A449, A490, and A540 bolting is used in structural applications. The applicant stated that of these bolting materials, A325 and A490 are the only ones that are specified as high-strength bolting. The applicant further stated that SRP-LR Table 3.5-1, item 3.5.1-69 states that "ASTM A325, F1852, and ASTM A490 bolting used in civil structures have not shown to be prone to SCC. SCC potential need not be evaluated for these bolts." The applicant stated that lubrication is not applied to the threads of structural bolting unless specified, and there is no lubricant specified or used for A325 and A490 high-strength structural bolting. Based on a review of the ASTM material specifications, the staff independently verified that it is unlikely that structural bolting supplied to ASTM specifications A36, A276, A307, and A449, would be found to exceed a yield strength of 150 ksi. For example, the highest minimum specified yield strength for A276 is 125 ksi and for A449 it is 92 ksi. However, for A540, several grades of material (e.g., B21, B22) have minimum specified yield strength values of 140 or 150 ksi. The staff lacked sufficient information on the specific grades, measured properties, and the control and inspection of A540 bolting used at the applicant's facility. In addition, the applicant's response did not describe what parameters or criteria would be used to detect a corrosive environment that could lead to future SCC of high-strength bolting.

By letter dated November 14, 2012, the staff issued RAI B.2.4-1a requesting that the applicant state: (a) the grade and class of A540 bolting used for in-scope structural locations; (b) the actual measured yield strength of in-service bolting; (c) what controls will be in place to ensure that the actual measured yield strength of A540 bolting supplied as replacements will not exceed 150 ksi; (d) if high strength A540 bolting has been used in in-scope structural applications, what inspections will be conducted; (e) the definition for a corrosive environment and the threshold for which an environment will be classified as corrosive; and (f) how it will be demonstrated that a non-corrosive environment is maintained for all high-strength bolting, and how visual inspections will be able to detect all instances of corrosion or a corrosive environment.

By letter dated January 21, 2013, the applicant provided its response RAI B.2.4-1a. In its response the applicant stated that:

(a) The only A540 bolting material used for in-scope structural locations is A540 Grade B23, Class 3, hereinafter referred to as A540.

(b) There are 216 A540 bolts or studs greater than nominal 1-inch diameter that are susceptible to SCC. For example, some bolting material has measured yield strengths of 154 ksi and 161.5 ksi. The susceptible population includes those bolts and studs with certified mill test reports (CMTR) results exceeding 150 ksi and studs with unknown yield strength. If a CMTR is located for a stud with currently unknown yield strength, and its yield strength is less than 150 ksi, it will be removed from the susceptible population. The susceptible anchor bolts and studs are located in containment and embedded in concrete with the exposed portions (e.g., support plates, nut(s)) being coated. The exposed portions of the bolting is coated.

(c) LRA Section B.2.39, Structures Monitoring Program, and Commitment No. 20 was amended to include an enhancement to, "[r]evise the applicable structural bolting specifications to prevent future use of A540 bolting with measured yield strength equal to or exceeding 150 ksi."

(d) Periodic visual inspections of the entire population of susceptible high-strength bolting will be conducted, with each inspection being completed prior to the period of extended operation and at an interval not to exceed five years. The visible portions of the bolt or stud and immediately adjacent support and structural materials will be inspected. The applicant also stated that "[a] review of both Davis-Besse specific and industry generic

Operating Experience for A540 bolting has not identified a history of failures related to SCC. Molybdenum Disulfide (MoS_2) was not required, nor prohibited, for any of the bolts in the structural bolting population during installation." In addition, the applicant has an extensive history of volumetric examinations of reactor head closure studs which are supplied as A540, Grade B23 material, of which 100 percent of the studs are examined in each 10-year ISI interval. These studs have a measured yield strength in the range of 151 ksi to 159 ksi. No evidence of SCC has been identified.

(e) A corrosive environment consists of "a moist or wetted environment that includes contaminants that could aid in the inducement of SCC." Visual inspections will detect the presence of a potential corrosive environment by observing for indications of standing water, residue of evaporated water, visible moisture from condensation or any other source, water trails or stains to or from the bolting location, residue on adjacent concrete surfaces suggesting that a water trail might have existed, evidence of corrosion on bolting or adjacent metal support components, corrosion stains on adjacent concrete surfaces, and any other evidence of current or past presence of a moist or wetted environment at or adjacent to a bolting location. The visual inspections will also include observing for visible evidence of loss of preload or bolting misalignment. If there is evidence of a corrosive environment or SCC, the issue will be entered into the Corrective Action Program and an engineering evaluation will be conducted. The applicant stated that:

> The threshold for which an environment will be classified as corrosive will be a formal written engineering evaluation that determines that there is not reasonable assurance that the specific bolting environment has remained non-corrosive. The Structures Monitoring AMP is updated to include the definition of a corrosive environment, the process for identifying a corrosive environment, and the threshold for a corrosive environment.

(f) Ultrasonic (volumetric) examinations will be performed in accordance with ASME Code Section V, Article 5, Appendix IV, on a representative sample of susceptible A540 bolting that is determined to be or to have been subjected to a corrosive environment. The volumetric examinations will occur no later than the subsequent RFO following visual identification of the bolting being subjected to a corrosive environment; however, examinations will not be deferred to the next outage if there is evidence that contaminants penetrated through the coating. The examination volume extends from the exposed nut engagement area to an embedded depth of at least 12 inches. The representative sample size will be equal to 20 percent of the population subjected to a corrosive environment, with a maximum of 25 bolts or studs. Examination personnel will be required to have a current ASME Code Section XI, Appendix VIII, Supplement 8 endorsement.

LRA Section B.2.39, Structures Monitoring Program, and Commitment No. 20 reflect the critical aspects of the response to the RAI, as stated above. LRA Section A.1.39 was revised to include, "[v]isual inspections are supplemented by volumetric examination or by feel (for elastomers), as needed."

The staff finds the applicant's response in part acceptable because:

- The applicant has appropriately identified the scope of high-strength structural bolting by using CMTR data and conservatively included those A540 studs for which they have no CMTR data.

- The entire population of susceptible high-strength bolting will be visually examined for signs of a corrosive environment and visible evidence of loss of preload or bolting misalignment prior to the period of extended operation and on a five-year interval throughout the period of extended operation. The applicant's proposed list of potential evidence of a corrosive environment is extensive, including signs of current leakage, past leakage, and leakage on adjacent components. The visual examinations are capable of detecting signs of a corrosive environment and SCC that has resulted in loss of preload or misalignment. Given that plant-specific operating experience (36 years) has not revealed any indications of SCC, including numerous volumetric examinations of bolting manufactured to the same material specification, and the significant amount of bolting that will be inspected, a five-year interval is acceptable.
- The exposed portions of the bolt or stud are coated. Therefore, as long as the coating remains intact, the susceptible material is isolated from the corrosive environment.
- It is unlikely that environmental conditions will change in containment during the period of extended operation. Therefore based on the lack of evidence of SCC in high-strength bolting to date, the proposed sample size of volumetric examinations is consistent with the sampling methodology as recommended in GALL Report AMP XI.M32.
- When evidence of a corrosive environment is detected, a volumetric exam of the bolting will be conducted by qualified ASME Section V procedures and qualified examiners. The examination volume (i.e., from the nut to 12 inches imbedded within concrete) is sufficient because it is unlikely that corrosive compounds or oxygen would penetrate past 12 inches.
- The volumetric inspections will be conducted when the corrosive environment is discovered unless it is demonstrated that the coating is intact. An intact coating isolates the susceptible metal from the environment that causes SCC.
- LRA Section B.2.39, Structures Monitoring Program, and Commitment No. 20 reflect the critical aspects of the response to the RAI, as stated above.

However, the staff does not find the following aspects of the response acceptable:

- Based on the staff's review of the list of conditions that would indicate a potentially corrosive environment, only three of the eight were associated with some measure of standing water. It is not clear to the staff what factors engineering will consider in determining whether a potentially corrosive environment is a corrosive environment, particularly when no moisture is present.
- The applicant has proposed to volumetrically examine a representative sample of 20 percent of the population of high-strength bolting subjected to a corrosive environment, with a maximum of 25 bolts or studs. It is not clear how many bolts or studs will be examined if fewer than five are exposed to a corrosive environment.
- In regard to LRA Section A.1.39, while it could be inferred that high-strength structural bolting will be volumetrically examined, it is not clearly stated.

Therefore, the staff's concerns described in RAI B.2.4-1 and RAI B.2.4-1a were not fully resolved. By letter dated February 14, 2013, the staff issued RAI B.2.4-1b requesting that the applicant:

(a) State the factors engineering will consider in determining whether a potentially corrosive environment is a corrosive environment, particularly when no moisture is present

(b) State how many bolts or studs will be volumetrically inspected when fewer than five bolts or studs are found to be exposed to a corrosive environment.

(c) Clarify LRA Section A.1.39 regarding the volumetric examination of high-strength structural bolting.

In its response dated March 14, 2013, the applicant:

(a) Stated nine factors that engineering would consider to determine if a corrosive environment existed if moisture is present when visual inspections of bolting are conducted. The applicant also stated 10 factors that engineering would consider when moisture is not present when the bolting is visually inspected but there is evidence of past moisture. Examples of the factors stated by the applicant include the visible or likely pathway, if any, that the liquid traversed to arrive at or near the bolting; the material condition of the coatings on the bolting, and associated support; the probable sources of past leakage or condensation that could have supplied the moisture; the probable or analyzed chemical characteristics of any moisture residue, including the presence of contaminants; and the characteristics of any corrosion on or near the bolting. The applicant also stated that, "[a]ll factors that are present will be evaluated together to provide the most accurate characterization of the environment to which each evaluated bolt or stud has been exposed."

(b) Stated that if fewer than five bolts or studs are found to be exposed to a corrosive environment, one bolt or stud will be volumetrically inspected.

(c) Revised LRA Section A.1.39 to include bolting considered to be high-strength, including bolting with a measured yield strength equal to or greater than 150 ksi and bolting with undocumented yield strength. LRA Section A.1.39 was also revised to state that (1) periodic visual inspections are conducted every 5 years; (2) based on the visual inspections, engineering will determine if a bolt was susceptible to a corrosive environment; and (3) 20 percent (rounded up to the nearest whole number) of bolts exposed to a corrosive environment will be volumetrically examined with a maximum sample size of 25.

The staff finds the applicant's response to RAI B.2.4-1b in part acceptable because (1) the applicant cited multiple appropriate factors that will be used in conjunction with each other to determine whether a corrosive environment exists or had existed, (2) no less than one bolt or stud will be volumetrically examined if a corrosive environment exists, and (3) the USAR supplement includes appropriate controls to ensure the program will be implemented as described.

Subsequent to the applicant's response as described above, the staff determined that in addition to structural applications, high-strength bolting could have been used in ASME Code

Section XI applications. The aging effects for high-strength bolting in ASME Code Section XI applications are managed by GALL Report AMP XI.S3, “ASME Section XI, Subsection IWF” hereinafter referred to as IWF. The exemption for not considering SCC of A325, F1852, and A490 bolts as provided for in SRP-LR (Revision 2) Table 3.5-1, item 3.5.1-69 is not applicable for ASME Code Section XI bolting. During telephone conference calls conducted on April 11, April 24, and May 2, 2013, the applicant stated that Davis-Besse has high-strength structural bolting (i.e., actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter in the IWF bolting population consisting of material types ASTM A490 and A540. Therefore, by letter dated May 17, 2013, the applicant provided a suplemental response to RAI B.2.4.-1b. In the supplemental response the applicant stated that:

- Material type A490 and A540 high-strength bolts in sizes greater than 1-inch nominal diameter have been used in ASME Code Section XI IWF applications.
- The A325 bolts in the IWF bolting population were determined not to be high-strength because the specified minimum yield strength for the subject A325 Type 1 bolting is 81 ksi, which is substantially below the high-strength threshold of 150 ksi. In addition, the CMTRs for 214 A325 bolts confirmed that the yield strengths are less than 150 ksi.
- The A540 bolts used in IWF applications have a specified minimum yield strength of 130 ksi. The “detection of aging effects” program element of GALL Report AMP XI.S3, allows for a waiver of volumetric examinations similar to GALL Report AMP XI.M18. As stated above, a review of both Davis-Besse specific and industry generic operating experience for A540 bolting has not identified a history of failures related to SCC. In addition, the applicant has an extensive history of volumetric examinations of reactor head closure studs which are supplied as A540, Grade B23 material, of which 100 percent of the studs are examined in each 10-year ISI interval. These studs have a measured yield strength in the range of 151 ksi to 159 ksi. No evidence of SCC has been identified.
- The Inservice Inspection (ISI) – IWF Program has been revised to include volumetric examination of A490 high strength bolting (i.e., actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter to detect potential cracking. The volumetric examinations will be performed in accordance with the requirements of the ASME Code, Section V, Article 5, Appendix IV, 2007 Edition through 2008 Addenda. The representative sample size will be equal to 20 percent (rounded up to the nearest whole number) of the entire IWF population of A490 high-strength bolts in sizes greater than 1 inch nominal diameter, with a maximum sample size of 25 bolts. The selection of the representative sample will consider susceptibility to SCC (e.g., actual measured yield strength) and as low as reasonably achievable (ALARA) radiation dose reduction principles. The frequency of examination will be once each 10-year ISI interval beginning with the fourth interval that started on September 21, 2012.

The staff finds the applicant’s response in part acceptable because:

- The specified material type for A325 bolting in IWF applications has a minimum specified yield strength of 81 ksi. Sufficient margin exists between 81 ksi and 150 ksi to establish reasonable assurance that the as-supplied yield strength would be less than 150 ksi. In addition, the applicant reviewed 214 A325 CMTRs and found none exceeding 150 ksi.
- The applicant will conduct periodic (i.e., each inservice inspection interval) volumetric examinations of A490 high-strength IWF bolting using ASME Section V methods, The sample size will be 20 percent of the population with a maximum of 25 bolts being

inspected. The bolting to be sampled will be selected from that most susceptibile to SCC (e.g., actual measured yield strength) and ALARA radiation dose reduction principles. The ISI intervals and the sample size are consistent with GALL Report AMPs for frequency of inspection (e.g., every 10-year inspections of buried pipe in GALL Report (Revision 2) AMP XI.M41, "Buried and Underground Piping and Tanks") and size (20 percent with a maximum of 25 components in GALL Report AMPs XI.M32, "One-Time Inspection," and GALL Report XI.M33, "Selective Leaching") and therefore provide reasonable assurance that SCC would be detected.

- Inspecting only the high-strength structural bolting greater than 1-inch nominal diameter for SCC is consistent with the "detection of aging effects" program element of GALL Report AMP XI.S3.
- LRA Sections A.1.23 and B.2.23 were revised to reflect the inspection requirements for A490 IWF bolting. In addition, the applicant added a new license renewal commitment (Commitment No. 50) to track the implementation of the changes to testing of A490 IWF bolting.

However, the staff does not find the supplemental response completely acceptable because the IWF A540 bolts were not included in the periodic visual inspection population stated above for structural A540 bolting. Given that neither periodic volumetric examination of IWF A540 bolting or visual inspections to detect a potential corrosive environment will be conducted, the staff lacks reasonable assurance that SCC in IWF A540 bolts will be detected. Therefore, the staff held a telephone conference call with the applicant on May 28, 2013, to communicate the above concerns.

In response to the staff's concerns, by letter dated June 4, 2013, the applicant provided a supplemental response to RAI B.2.4-1b. In its response the applicant stated that the Inservice Inspection (ISI) - IWF Program will conduct one of the following two inspections schemes:

(1) The applicant stated that periodic visual inspections of 100 percent of susceptible A540 bolting will be conducted prior to the period of extended operation and at an interval not to exceed five years to identify locations where the susceptible A540 bolting may be exposed to a potentially corrosive environment for SCC. The applicant also stated that if the visual inspections identify one or more bolts in a potentially corrosive environment, then an engineering evaluation is performed to determine whether the bolting material had been subjected to a corrosive environment for SCC. If it is determined that any bolt has been exposed to a corrosive environment for stress corrosion cracking a representative sample (i.e., 20 percent (rounded up to the nearest whole number) of the bolts in the sample population, with a maximum sample size of 25 bolts) will be volumetrically examined in accordance with the requirements of ASME Code Section V, Article 5, Appendix IV. The applicant further stated that volumetric examinations will be performed no later than the subsequent refueling outage following visual identification of bolting subject to a corrosive environment, although deferral of exams to the next refueling outage will not be permitted if the visual inspection indicates evidence of contaminant penetration through the coating. The frequency of examination is once each 10-year ISI interval beginning with the 4th interval that started September 21, 2012.

(2) The applicant stated that it will conduct periodic (i.e., each inservice inspection interval) volumetric examinations of A540 high-strength IWF bolting using ASME Section V methods. The applicant also stated that the sample size will be 20 percent of the population with a maximum of 25 bolts being inspected. The applicant further stated that

the bolting to be sampled will be selected from that most susceptible to stress corrosion cracking (e.g., actual measured yield strength) and as low as reasonably achievable (ALARA) radiation dose reduction principles.

The staff finds the applicant's response acceptable because (a) 100 percent of high-strength A540 bolting within the scope of the Inservice Inspection (ISI) - IWF Program will be either visually inspected to ensure that a corrosive environment has not occurred, with follow-up volumetric exams if a corrosive environment has occurred, or a representative sample will be volumetrically examined each ISI interval; (b) both of these inspection schemes provide reasonable assurance that SCC is not occurring in the high-strength bolting; (c) LRA Sections A.1.23 and B.2.23 have been revised to reflect the change; and (d) the applicant included a new license renewal commitment (Commitment No. 50) for the Inservice Inspection (ISI) - IWF Program to ensure that the above described enhancements would be included in the program implementing procedures. The staff's concern described in RAIs B.2.4-1, B.2.4-1a, and B.2.4-1b are resolved.

GALL Report AMP XI.M18 indicates that use of MoS_2 as a lubricant is a potential contributor of SCC and should not be used. During the staff's review of operating experience during the audit, the staff noted that the applicant's Bolting Integrity Program identified certain instances where lubricants containing MoS_2 were approved for use, but the operating experience review did not show cases where lubricants had caused degradation. The applicant also stated that this lubricant was used on Westinghouse DHP circuit breakers, AKF circuit breakers, Westinghouse motor control centers, and the reactor vessel stud tensioners. It was unclear to the staff to what extent the applicant has used MoS_2 as a lubricant. It was also not clear to the staff if the applicant will be replacing MoS_2 with an alternate lubricant on bolting applications.

By letter dated April 20, 2011, the staff issued RAI B.2.4-3 requesting that the applicant clarify for which specific systems, components, and applications MoS_2 is used as a lubricant. The applicant was also asked to describe any plans to replace MoS_2 with an alternate lubricant. In its response dated May 24, 2011, the applicant stated that LRA Section B.2.4 is revised to include a new enhancement to the Bolting Integrity Program and a corresponding new license renewal commitment in LRA Table A-1, which will select an alternate stable lubricant that is compatible with the bolting material and the environment. A specific precaution against the use of compounds containing sulfur (sulfide) including MoS_2, as a lubricant is also included in the program.

The staff finds the applicant's response acceptable because the staff confirmed that the operating experience review did not show cases where the MoS_2 lubricant had caused degradation. The staff also reviewed EPRI-5769, Volume 1, Section 11, "Degradation and Failure of Bolting in Nuclear Power Plants, Volumes 1 and 2," EPRI, April 1988, and found that it specifically identifies lubricants containing MoS_2 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 MoS_2 as a lubricant for bolting. Additionally, periodic inspections provide ongoing opportunities to detect the aging effect if it should occur. Lastly, the Bolting Integrity Program includes requirements for implementing corrective actions if unacceptable indications of cracking are found. The staff's concern in RAI B.2.4-3 is resolved.

The staff also reviewed portions of the "scope of program," "preventive actions," "corrective actions," and "monitoring and trending" program elements associated with exceptions to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions follows.

Exception 1. LRA Section B.2.4 states an exception to the "scope of program," "preventive actions," and "corrective actions" program elements. The applicant stated that the Bolting Integrity Program does not explicitly address the guidelines outlined in EPRI NP-5769, or those outlined in NUREG-1339, "Resolution of Generic Safety Issue 29; Bolting Degradation or Failure in Nuclear Power Plants," for safety-related bolting. The applicant stated these guidelines apply only to safety-related bolting and primarily to nuclear steam supply system (NSSS) bolting. The applicant further stated that the Bolting Integrity Program relies on the recommendations from the manufacturer, the vendor and industry in general, as contained in EPRI documents TR-104213, "Bolted Joint Maintenance & Application Guide," EPRI, December 1995,and TR-111472, "Nuclear Maintenance Applications Center: Assembling Gasketed, Flanged Bolted Joints," EPRI, December 2007, for bolting maintenance.

The staff reviewed this exception and compared it to the GALL Report and noted that the applicant does not follow the guidelines per the EPRI NP-5769 or NUREG-1339, as recommended by the GALL Report.

By letter dated April 20, 2011, the staff issued RAI B.2.4-2 requesting that the applicant provide clarification on the use of EPRI TR-111472 as guidance for this program and to provide an explanation of any contradictions between EPRI TR-111472 and the GALL recommended guidance delineated in EPRI NP-5769 and NUREG-1339 that it is replacing and their impact on this program. In its response dated May 24, 2011, the applicant stated that the EPRI document TR-111472 is a plant maintenance and training module based upon EPRI NP-5067, "Good Bolting Practices A Reference Manual for Nuclear Power Plant Maintenance Personnel," EPRI, Volume 1, 1987 and Volume 2, 1990, and EPRI TR 104213, which provide guidance for proper material selection, preload and assembly, and maintenance and inspection of safety-related bolting and other bolting. The staff notes that although EPRI NP-5067 is not directly referenced in GALL Report AMP XI.M18, the recommendations set forth in EPRI NP-5067, Volumes 1 and 2, form an important basis to the industry documents referenced in GALL Report AMP XI.M18 such as EPRI NP-5769 and NUREG-1339. Both EPRI NP-5769 and NUREG-1339 defer to EPRI NP-5067 for the identification of bolting practices associated with disassembly and assembly of bolted joints and identification of bolting practices for minimizing bolted joint problems such as leaks, vibration loosening, fatigue, and SCC. The applicant further clarified that these standards do not contradict the guidance for bolting integrity provided in NUREG-1339, EPRI NP-5769, or EPRI TR-104213, which are cited in GALL Report AMP XI.M18.

The staff finds the applicant's response to RAI B.2.4-2 acceptable for the following reasons:

- EPRI TR-111472 is a training module based upon EPRI NP-5067, which provides both the detailed bolting practices and the underlying basis for subsequent industry guideline documents.
- The staff confirmed that EPRI NP-5067 provides the same information as EPRI NP-5769 for addressing the bolting integrity recommendations in GALL Report AMP XI.M18.
- The use of EPRI TR-111472 does not contradict the bolting integrity guidance provided in GALL Report AMP XI.M18.

The staff's concern described in RAI B.2.4-2 is resolved.

The exception to the “scope of program,” “preventive actions,” and “corrective actions,” is appropriate because the applicant referenced relevant documents that provided adequate guidelines as indicated in GALL Report AMP XI.M18. Therefore, the staff determines that the applicant’s exception to the “scope of program,” “preventive actions,” and “corrective actions” program elements is acceptable.

Exception 2. LRA Section B.2.4 states an exception to the “monitoring and trending” program element. The applicant stated that its Bolting Integrity Program does not follow a pre-set inspection frequency (weekly or biweekly) for followup inspections of bolted connections that are reported to be leaking. The applicant also stated that leaks that could result in a challenge to a system or component function are entered into the Corrective Action Program to ensure that evaluations are performed and corrective actions are applied. The applicant further stated that depending on the magnitude and significance of the leak, corrective actions may include periodic monitoring and trending of leakage. The applicant also indicated that leaks that do not constitute a challenge to a system or component function are entered into a work management process where periodic inspections are performed during daily walkdowns and maintenance of the plant.

The staff reviewed the exception and determined that the component-specific or application-specific corrective actions and inspections after leakage are acceptable because the applicant will assess each event, record the occurrence, place it into a Corrective Action Program, and perform periodic inspections, monitoring, and trending based upon the nature of the leakage event. Furthermore, the staff notes that the current staff position documented in Revision 2 of GALL Report AMP XI.M18 indicates that management of leakage from a bolted connection in accordance with the corrective action process is an appropriate method to ensure timely detection of applicable aging effects.

With the information provided in the LRA and also supported by the current staff position documented in Revision 2 of GALL Report AMP XI.M18, the staff finds the program exception acceptable because the applicant identified a rigorous process and credited its Corrective Action Program, which will be able to manage leakage from bolted connections to ensure timely detection of applicable aging effects.

Based on its audit, the staff finds that elements one through six of the applicant’s Bolting Integrity Program, with exceptions, are consistent with the corresponding program elements of GALL Report AMP XI.M18 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.4 summarizes operating experience related to the Bolting Integrity Program since 2002. The applicant stated that the head of one of two bolts holding an emergency diesel generator (EDG) jacket water elbow to the head of the cylinder was found to be loose. The applicant also stated that the head came off with minimal effort, but no leakage was found around the immediate area. During onsite discussions with the staff, the applicant clarified that the component was sent out for failure investigation, which resulted in indications that the bolting material was found not to conform to specification and contributed to the failure. The bolt was replaced. The applicant also cited an operating experience where a corroded expansion anchor for a tubing support was found. The applicant indicated that the anchor had been corroded by groundwater leaking through an adjacent wall penetration. The leak was corrected and the anchor bolt was repaired.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that the operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.4 provides the USAR supplement for the Bolting Integrity Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.1-2, 3.2-2, 3.3-2, and 3.4-2.

The staff also noted that the applicant committed (Commitment No. 34) to enhance the Bolting integrity Program prior to entering the period of extended operation. Specifically, the applicant committed to selecting an alternate stable lubricant that is compatible with the bolting material and the environment, and adding a specific precaution against the use of compounds containing sulfur (sulfide), including MoS_2 as a lubricant. The staff further noted that appropriate details have been included in LRA Section A.1.39 for age-managing high-strength structural bolting inside containment and embedded (except for the exposed portion beyond the base plate) in concrete.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Bolting Integrity Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 34 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for the AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.7 describes the existing Buried Piping and Tanks Inspection Program as consistent, with enhancements, with GALL Report AMP XI.M34, "Buried Piping and Tanks Inspection." The applicant stated that the Buried Piping and Tanks Inspection Program manages the effects of corrosion on the external surfaces of piping, tanks, and associated bolting exposed to a buried soil environment. The applicant also stated that the program is a combination of a mitigation program through protective coatings and a condition monitoring program through visual inspections. The applicant further stated that the program manages loss of material for steel piping, tanks, and associated bolting, which are provided with protective coatings. Additionally, the program manages loss of material for gray cast iron piping and piping components, which are not provided with protective coatings.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

Although the applicant submitted its program to the recommendations of GALL Report, Revision 1, AMP XI.M34, the staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M41 because GALL Report, Revision 2, represents the current staff position for managing the aging of buried and underground piping and tanks. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M41, with the exception of the "preventive actions," "detection of aging effects," and "acceptance criteria" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

GALL Report AMP XI.M41 recommends that inspection locations should be risk-informed, based on susceptibility to degradation and consequence of failure under the "detection of aging effects" program element; however, during its audit, the staff did not have sufficient information to determine if the applicant will use risk-informed criteria to select inspection locations. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(2) requesting that the applicant state whether buried and underground in-scope piping inspection locations will be selected based on risk factors considering susceptibility to degradation and consequences of failure. If inspection locations are not risk-informed, the staff asked the applicant to state how the inspections that are conducted will be representative of piping locations that are most susceptible to degradation and result in the worst adverse consequences.

In its response dated May 24, 2011, the applicant stated that the buried pipe inspection locations are selected based on risk factors considering susceptibility to degradation and consequences of failure.

The staff finds the applicant's response acceptable because the applicant's selection of inspection locations is consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(2) is resolved.

GALL Report AMP XI.M41 recommends that buried in-scope steel piping should be cathodically protected under the "preventive actions" program element; however, the LRA and USAR do not contain enough details to determine if the buried in-scope service water piping is cathodically protected. In addition, USAR Section 9.5.4.2 states, "[c]orrosion of the tanks [fuel oil storage] will be prevented by protective coatings, and by cathodic protection if necessary." Therefore, it is not clear to the staff if the fuel oil tanks are cathodically protected. Additionally, the LRA does not state the availability of the cathodic protection system and what periodic testing is conducted on the cathodic protection system. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(3) requesting that the applicant state the following:

- whether the service water system and EDG fuel oil storage tanks are cathodically protected, including, if portions of a system are protected, what portions are not protected

- the availability of the cathodic protection system and, if portions of the system are not available 90 percent of the time or will be allowed to be out of service for greater than 90 days in any given year, state how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation
- whether annual ground potential surveys of the cathodic protection system are conducted and what acceptance criteria is used or, if annual ground potential surveys are not conducted, state how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation
- what cathodic protection system inspection and testing parameters will be trended and evaluated for adverse changes and, if these parameters do not include potential difference and current measurements, state how the effectiveness of the systems or coatings or both will be evaluated

In its responses dated May 24, 2011, and June 17, 2011, the applicant provided the following information.

- An upgrade of the cathodic protection system is in progress in order to meet NACE SP0169-2007 and NACE SP0285-2002. The EDG fuel oil piping cathodic protection has been proven to be effective based on testing. The test did not evaluate cathodic protection for the EDG fuel oil storage tanks. The in-scope service water piping is not cathodically protected. The applicant committed (Commitment No. 44) to cathodically protect the EDG fuel oil storage tanks, in-scope fuel oil piping, and in-scope service water piping prior to entering the period of extended operation. In addition, the applicant revised LRA Section A.1.7, USAR supplement, to state that cathodic protection is provided as a preventive measure.
- The cathodic protection system for the emergency diesel fuel oil piping has been available 100 percent of the time since its last inspection. In order to provide a reasonable assurance that buried in-scope piping meets its minimum design wall thickness throughout the period of extended operation if cathodic protection is not maintained available for 90 percent of the time, the applicant committed (Commitment No. 3) to inspect 2 percent of buried in-scope piping containing hazardous materials (i.e., fuel oil piping). Likewise, the EDG fuel oil storage tanks will be inspected prior to entering the period of extended operation if the tanks are not cathodically protected in accordance with NACE standards. These inspections will include a visual inspection of at least 25 percent of each tank, including at least some portion of the tank top and bottom, or an internal volumetric examination with at least one measurement per square foot of tank surface.
- Annual ground potential surveys of the cathodic protection systems will be conducted to the acceptance criteria contained in the NACE standards. The staff noted that the applicant committed (Commitment No. 3) to enhance its Buried Piping and Tanks Inspection Program to include this testing.
- Cathodic protection voltage and current will be monitored monthly to determine the effectiveness of cathodic protection systems. Voltage, current, and ground potential readings will be trended and evaluated for adverse changes. The staff noted that the applicant committed (Commitment No. 3) to enhance its Buried Piping and Tanks Inspection Program to include this trending and evaluation.

The staff finds the applicant’s response to RAI B.2.7-1(3) acceptable for the following reasons:

- In-scope buried steel tanks and piping, except for fire protection piping, will be cathodically protected prior to entering the period of extended operation. The staff noted that given the applicant's response to RAI B.2.7-1(5), below, GALL Report AMP XI.M41 allows cathodic protection to not be installed on fire protection piping.
- The applicant demonstrated that cathodic protection is available greater than 90 percent of the time for buried in-scope fuel oil piping, and, if availability falls below 90 percent, the alternative inspections for the buried in-scope piping and tanks are consistent with GALL Report AMP XI.M41.
- The annual ground potential surveys of the cathodic protection system and monitoring and trending of the cathodic protection system effectiveness are consistent with GALL Report AMP XI.M41.

The staff's concern described in RAI B.2.7-1(3) is resolved.

GALL Report AMP XI.M41 recommends that the backfill within 6 in. of buried in-scope steel piping should meet Section 5.2.3 of NACE SP0169-2007, and backfill meeting American Society for Testing and Materials (ASTM) D 448-08 size number 67 is considered acceptable by the staff under the "preventive actions" program element; however, the LRA does not describe the quality of the backfill in the vicinity of buried in-scope piping. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(4) requesting that the applicant state if the backfill within 6 in. of buried in-scope steel piping meets NACE SP0169-2007. If not, the staff asked the applicant to state how the buried pipe coatings will not be potentially damaged by the backfill.

In its response dated May 24, 2011, the applicant stated that the plant-specific backfill specifications do not conform to ASTM D 448-08 size number 67; however, they do specify granularity size distribution sufficient to avoid coating damage. The applicant also stated that direct and opportunistic inspections will evaluate the condition of coatings and backfill and that, based on inspection results to date, there has been no mechanical damage to the coatings from the backfill.

The staff finds the applicant's response acceptable because GALL Report AMP XI.M41 allows buried pipe inspections that demonstrate that the backfill has not caused mechanical damage to pipe coatings to be an alternative to meeting ASTM D 448-08 size number 67 backfill material. The staff's concern described in RAI B.2.7-1(4) is resolved.

GALL Report AMP XI.M41 recommends that steel piping should be coated or, if a buried fire protection piping system was designed to National Fire Protection Association (NFPA)-24 and is tested to NFPA-25, the preventive measures of GALL Report AMP XI.M41 do not apply under the "preventive actions" program element. However, the staff noted that USAR Table 9.0-1 states that the fire protection piping and components were installed to NFPA requirements, but it did not specify NFPA-24. The staff also noted that LRA Section B.2.1.18 states that periodic flow testing is conducted in accordance with NFPA-25, but it also states that some portions are not flow tested. The staff does not have sufficient information to determine that the buried in-scope fire protection piping was constructed to NFPA-24 and is periodically tested to the requirements of NFPA-25. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(5) requesting that the applicant do the following for buried in-scope uncoated fire protection cast iron piping:

- explain what specific NFPA code was used for the design and installation of the in-scope buried fire protection piping and, if the design code was not NFPA-24, explain if it required that cast iron piping be coated and state why there is a reasonable assurance that the uncoated cast iron piping will meet its current CLB function(s) throughout the period of extended operation

- clarify whether all portions of the buried in-scope fire protection piping will be periodically flow tested in accordance with NFPA-25 and, if all or some portions of the buried in-scope fire protection piping will not be periodically flow tested in accordance with NFPA-25, state why there is a reasonable assurance that the uncoated cast iron piping will meet its current CLB function(s) throughout the period of extended operation

In its response dated May 24, 2011, the applicant stated that NFPA-24-1968/73 was used for the design and installation of the in-scope buried fire protection piping, and Commitment No. 3 was modified to include an enhancement to the program that requires monitoring of the jockey pump or equivalent parameter and conducting a followup flow test by the end of the next RFO when unexplained changes are observed.

The staff finds the applicant's response acceptable because the fire protection piping was designed and installed to NFPA-24, consistent with GALL Report AMP XI.M41. Additionally, monitoring the jockey pump or equivalent parameter and conducting a followup flow test by the end of the next RFO when unexplained changes are observed is also consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(5) is resolved.

GALL Report AMP XI.M41 recommends that the inspection sample size be doubled if adverse indications are found under the "detection of aging effects" program element. Given that the LRA Section B.2.7 describes a 1995 fuel oil leak, a 2002 holiday (i.e., location of missing coating) in a fuel oil line, 2008 fuel oil line holidays leading to pitting and minor corrosion, and 2008 condensate demineralizer backwash line coating damage, it is not clear to the staff how the applicant is informing the number of required inspections based on plant-specific operating experience. LRA Section B.2.7 states that degradation or leakage found during inspections is entered into the Corrective Action Program to ensure evaluations are performed and appropriate corrective actions are taken, but it does not state the expansion of scope size. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(10) requesting that the applicant state the sample size increase that will occur if adverse conditions are discovered during inspections. If the inspection sample size is not initially doubled and then doubled again if adverse conditions are discovered in the initial and subsequent inspections, the staff asked the applicant to state why there is a reasonable assurance that the extent of condition has been discovered and evaluated.

In its responses dated May 24, 2011, and June 17, 2011, the applicant stated the following:

> Evaluation within the Corrective Action Program determines the potential extent of the degradation observed. Expansion of sample size may be limited by the extent of piping or tanks subject to the observed degradation mechanism. When an adverse condition is detected that is not limited by the degradation mechanism, inspection sample sizes within the affected piping categories are doubled. If adverse indications are found in the expanded sample, the inspection sample size is again doubled. This doubling of the inspection sample size continues as necessary.

The staff finds the applicant's response acceptable because the inspection sample size will be doubled if an adverse condition is detected; thus, it is consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(10) is resolved.

GALL Report AMP XI.M30 recommends that each fuel oil tank should have a periodic internal visual inspection, and if the visual inspection detects signs of degradation on the surfaces of the tank, a volumetric examination on the interior surfaces of the tank should be conducted. These inspections should be conducted once every 10 years starting 10 years prior to the period of extended operation for each tank under the "detection of aging effects" program element description. However, LRA Section B.2.20 states that the effectiveness of the Fuel Oil Chemistry Program is confirmed by the One-Time Inspection Program, which includes UT measurement of a sample of fuel oil tank bottoms to ensure that significant degradation is not occurring. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(11) requesting that, for the buried in-scope steel fuel oil tanks, the applicant explain the following:

- whether each fuel oil tank will have a periodic internal visual inspection and, if the visual inspection detects signs of degradation on the surfaces of the tank, explain if a volumetric examination on the interior surfaces of the tank will be conducted, or state why it is acceptable to not conduct these inspections
- if the frequency of inspection of the tanks exceeds 10 years, explain the basis for why the test frequency provides a reasonable assurance that the tank will not leak or be able to meet its CLB function(s)

In its response dated May 24, 2011, the applicant stated that each buried in-scope steel fuel oil tank will have a periodic internal visual inspection at a frequency not exceeding 10 years. If the visual inspection detects signs of degradation on the surfaces of the tank, a volumetric examination on the interior surfaces of the tank will be conducted.

The staff finds the applicant's response acceptable because the inspection frequency and followup volumetric examinations, if the visual inspection detects signs of degradation on the surfaces of the tank, is consistent with GALL Report AMPs XI.M30 and XI.M41. The staff's concern described in RAI B.2.7-1(11) is resolved.

GALL Report AMP XI.M41 recommends that the number of inspections to be conducted for a specific material of buried in-scope piping is, in part, based on its contents and function (i.e., code class, safety-related, contains hazardous materials) under the "detection of aging effects" program element description. LRA Table 3.3.2-12, row 102, states that there is steel piping externally exposed to soil. It is not clear if the internal environment is fuel oil, lubricating oil, or air. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(12) requesting that the applicant state whether the piping in LRA Table 3.3.2-12, row 102, has an internal environment of fuel oil, lubricating oil, or air.

In its response dated May 24, 2011, the applicant stated that the component identified in LRA Table 3.3.2-12, row 102, has an internal environment of fuel oil.

The staff finds the applicant's response acceptable because it provided sufficient information for the staff to identify the pipes internal environment. The staff notes that given the material, environment, and function that the applicant has selected, as stated in the amended LRA Section B.2.7, "detection of aging effects" program element and Commitment No. 3, the inspection size sample is consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(12) is resolved.

GALL Report AMP XI.41 recommends a minimum number of inspections of underground piping based on material type and function of the piping (i.e., code class, safety-related, contains hazardous materials) and each steel tank, and that underground piping is visually inspected to detect external corrosion and volumetrically examined to detect internal corrosion under the "detection of aging effects" program element description. LRA Section B.2.15 states that, "[s]urfaces that are inaccessible or not readily visible during either plant operations or RFOs, such as surfaces that are insulated, will be inspected opportunistically during the period of extended operation." Based on a review of the LRA, it is not clear to the staff which systems have underground piping or tanks and the length of piping or number of tanks that are underground. Given the "opportunistic" statement in the LRA, it is not clear if the applicant's program will inspect an adequate sample of underground piping and tanks. Additionally, it is not clear to what extent the applicant will conduct volumetric examinations of underground piping. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(13) requesting that the applicant state the following:

- the systems, function (i.e., code class, safety-related, contains hazardous material, nonsafety-related), material type and length of in-scope underground piping, and the number of underground steel tanks
- how many and the extent of visual and volumetric inspections that will be conducted of underground piping and steel tanks

In its response dated May 24, 2011, the applicant stated that an approximately 30-ft underground safety-related piping segment constructed of stainless steel exists in the decay heat removal (DHR) and low-pressure injection (LPI) system and is exposed to an internal treated borated water environment greater than 140 °F (60 °C). The function is to provide post-loss-of-coolant accident emergency core cooling from the BWST. The applicant also stated that the program is enhanced to include a visual and volumetric inspection of this piping that will be conducted during each 10-year period beginning no sooner than 10 years prior to entering the period of extended operation to confirm the absence of the aging effect. The applicant further stated that there are no underground steel tanks.

The staff finds the applicant's response acceptable for the following reasons:

- The Buried Piping and Tanks Inspection Program has been enhanced to include a visual and volumetric inspection of the only segment of underground piping.
- The inspections will be conducted during each 10-year period beginning no sooner than 10 years prior to entering the period of extended operation.
- There applicant has no underground tanks.
- Although the applicant did not state the extent of the visual and volumetric inspections, the short length of the pipe (i.e., 30 ft) and periodic inspections will provide reasonable assurance for the staff to conclude that the function(s) of the underground in-scope piping will remain consistent with the CLB.

The staff's concern described in RAI B.2.7-1(13) is resolved.

GALL Report AMP XI.M41 recommends that underground piping should be coated in accordance with Table 1 of NACE SP0169-2007 or the applicant should justify the alternative coating methodology under the "preventive actions" program element description; however, the staff does not have sufficient information to determine if the applicant's coatings for underground piping meet Table 1 of NACE SP0169-2007. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(14) requesting that the applicant state whether underground piping and tanks are coated in accordance with Table 1 of NACE SP-0169-2007 or justify why the existing coating or lack of coating provides a reasonable assurance that the uncoated piping will meet its current CLB function(s) throughout the period of extended operation.

In its response dated May 24, 2011, the applicant stated that the underground piping is stainless steel, and no coating is required to protect stainless steel in an air environment.

The staff finds the applicant's response acceptable because the only underground piping is constructed of stainless steel and the absence of coating as a preventive action for stainless steel piping is consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(14) is resolved.

GALL Report AMP XI.M41 recommends that if coated or uncoated metallic piping or tanks show evidence of corrosion, the remaining wall thickness in the affected area is determined to ensure that the minimum wall thickness is maintained under the "acceptance criteria" program element description. LRA Section B.2.7 states that degradation found during inspections is entered into the Corrective Action Program to ensure evaluations are performed and appropriate corrective actions are taken, but it does not state the remaining wall thickness in the affected area is determined to ensure that the minimum wall thickness is maintained. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(15) requesting that the applicant state whether the remaining wall thickness in the affected area will be determined to ensure that the minimum wall thickness is maintained if coated or uncoated metallic piping or tanks show evidence of corrosion. If the remaining wall thickness will not be measured, the staff asked the applicant to state how there is a reasonable assurance that the extent of corrosion is understood.

In its response dated May 24, 2011, the applicant stated that if coated or uncoated metallic piping or tanks show evidence of corrosion, the remaining wall thickness in the affected area will be determined to ensure that the minimum wall thickness is maintained.

The staff finds the applicant's response acceptable because the Buried Piping and Tanks Inspection Program and USAR supplement have been revised to require that if coated or uncoated metallic piping or tanks show evidence of corrosion, the remaining wall thickness in the affected area will be determined to ensure that the minimum wall thickness is maintained; therefore, the program is consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(15) is resolved.

The staff also reviewed the portions of the "scope of program" and "detection of aging effects" program elements associated with the enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.7 states an enhancement to the "scope of program" program element. The applicant stated that it will add the emergency diesel fuel oil storage tanks and bolting for buried fire protection system piping to the scope of the program.

The staff reviewed this enhancement against the corresponding program element in the GALL Report AMP XI.M41, which states that typical systems in which buried and underground piping and tanks may be found include fuel oil and fire protection piping and piping components and storage tanks. In addition, GALL Report AMP XI.M41 states that loss of material due to corrosion of piping system bolting is within its scope. On the basis of its review, the staff finds the applicant's enhancement acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL Report AMP XI.M41.

Enhancement 2. LRA Section B.2.7 states an enhancement to the "detection of aging effects" program element. The applicant stated that it expanded on the existing program element by adding the following:

- a requirement that an inspection of coated and wrapped buried piping or tank be performed within the 10-year period prior to entering the period of extended operation
- a requirement that an additional inspection of coated and wrapped buried piping or tank be performed within 10 years after entering the period of extended operation
- a requirement that an inspection of uncoated cast iron buried piping be performed within the 10-year period prior to entering the period of extended operation
- a requirement that an additional inspection of uncoated cast iron buried piping be performed within 10 years after entering the period of extended operation
- a requirement that an inspection of buried fire protection system bolting be performed when the bolting becomes accessible during opportunistic or focused inspections
- a requirement that the inspection of buried piping be conducted using visual (VT-3 or equivalent) inspection methods with approximately 10 linear feet of piping exposed for inspection

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41 and noted that the sample size and frequency proposed by the applicant for the inspection of coated and wrapped steel piping and uncoated cast iron piping may not provide a reasonable basis for assurance that the piping will meet its intended license renewal function(s) if a piping system is not cathodically protected. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(7) requesting that the applicant state the following:

- the minimum number of inspections of buried in-scope piping planned during the 30–40, 40–50, and 50–60 year operating period, including differentiating between material, code class, safety-related piping, and potential to contain hazardous material category piping inspection quantities of buried in-scope piping
- which inspections will be conducted by excavated direct visual inspection of the buried piping
- the length of each buried in-scope piping system
- why it is acceptable to not inspect in-scope pipe containing hazardous materials if there are no planned inspections for piping containing hazardous materials

In its response dated May 24, 2011, the applicant stated the following:

- The minimum number of buried in-scope piping inspections that will be conducted during the 30-40, 40-50, and 50-60 year operating periods is one steel safety-related piping segment and one steel piping segment containing hazardous material.
- Inspections will be conducted by excavated direct visual inspection.
- There are approximately 1,400 ft of EDG fuel oil piping, 8,500 ft of fire protection piping, and 1,500 ft service water piping.
- There are planned inspections for piping containing hazardous materials (i.e., fuel oil).

The staff finds the applicant's response acceptable for the following reasons:

- Cathodic protection has been installed on the buried in-scope EDG fuel oil piping.
- Cathodic protection will be installed on the buried in-scope service water piping and fuel oil storage tanks prior to entering the period of extended operation.
- Inspections will be conducted by excavated direct visual inspections.
- Applicant's planned number of inspections are consistent with GALL Report AMP XI.M41.

The staff's concern described in RAI B.2.7-1(7) is resolved.

In addition, GALL Report AMP XI.M41 recommends that the entire run of piping or minimum length of 10 ft be inspected under the "detection of aging effects" program element; however, Commitment No. 3 state that approximately 10 linear feet of piping will be exposed for inspections. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(8) requesting that the applicant state the minimum inspection length of excavated buried piping inspections and revise Commitment No. 3 to state the minimum inspection length of piping. If the length is shorter than 10 ft, the staff asked the applicant to state the basis for why this length will provide an adequate representative length of piping.

In its response dated May 24, 2011, the applicant stated that the minimum inspection length of excavated buried piping inspections is 10 ft, and LRA Table A-1, Commitment No. 3, was revised to state the minimum inspection length of piping.

The staff finds the applicant's response acceptable because the 10 ft minimum inspection length is consistent with GALL Report AMP XI.M41. The staff's concern described in RAI B.2.7-1(8) is resolved.

Based on its audit and review of the applicant's responses to RAIs B.2.7-1(2) through (5), (7), (8), and (10) through (15), the staff finds that elements one through six of the applicant's Buried Piping and Tanks Inspection Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL Report AMP XI.M41 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.7 summarizes operating experience related to the Buried Piping and Tanks Inspection Program. The applicant stated that a search of its operating experience identified an EDG underground fuel oil piping leak due to corrosion that appeared to be the result of damage to the piping coating and wrapping. The leak was documented in the Corrective Action Program in 1995, and the piping system was repaired in 1997. The applicant also stated that an assessment of the condition of the external surfaces of buried piping was performed in 2002 and that one holiday on the coatings for the emergency diesel fuel oil supply piping was identified and repaired. The applicant further stated that evaluations of fuel oil piping conditions concluded that a more robust cathodic protection system could further mitigate piping damage due to coating and wrapping deficiencies, leading to a new cathodic protection system being installed in 2008 for this piping. The applicant stated that an assessment of the condition of the external surfaces of buried piping performed in 2008 revealed damaged coatings (holidays) on three sections of buried emergency diesel fuel oil lines with instances of pitting and minor corrosion. The applicant also stated that an ultrasonic testing examination was performed on the area where pitting was identified, and the wall thickness was found to be greater than the nominal thickness for the pipe and was determined acceptable.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience, which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

In order to evaluate an applicant's Buried Pipe and Underground Piping Inspection Programs, the staff must be aware of plant-specific operating experience, which might include examples beyond those listed in the LRA. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(1) requesting that the applicant provide a list and brief summary, including cause, of any leaks or adverse conditions that have occurred in buried piping or tanks at the station in the past 5 years that were entered in the Corrective Action Program but not included in the LRA.

In its response dated May 24, 2011, the applicant stated that a review of plant-specific operating experience was conducted, and no leaks or adverse conditions were identified for buried in-scope piping in the past 5 years that were not included in the LRA.

The staff finds the applicant's response acceptable because the applicant confirmed that there were no additional identified leaks or adverse conditions for buried in-scope piping in the past 5 years. The staff's concern described in RAI B.2.7-1(1) is resolved.

LRA Section B.2.7 describes two instances of coating degradation—a 1995 example associated with a fuel oil piping leak and a 2008 example associated with a condensate demineralizer backwash line. The applicant did not state the cause of the coating degradation. In addition, the LRA describes the discovery of four different coating holidays. The staff needs to understand the causes of the failures in order to evaluate the effectiveness of the applicant's program. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(6) requesting that the applicant state the cause for the coating degradation that occurred in the 1995 example associated with a fuel oil piping leak and the 2008 example associated with a condensate demineralizer backwash line and the basis for having a reasonable assurance that planned inspections represent an adequate quantity to identify coating damage and holidays before leaks occur.

In its response dated May 24, 2011, the applicant stated that the apparent cause for the fuel oil piping leak documented in 1995 was damage to the coating caused by an individual standing on the pipe during construction, coupled with stray current corrosion and a loss of cathodic protection in the area. The applicant also stated that the apparent cause of the condensate demineralizer backwash line leak documented in 2008 was external corrosion due to coating failure, possibly caused by numerous previous excavations in the area, combined with an absence of cathodic protection. The applicant further stated that the basis for reasonable assurance is the increase in inspections from two in the time frame from 10 years prior to the period of extended operation to the end of extended operation to six inspections and that the inspection locations will be selected based on previous examination results, trending, risk ranking, and areas of cathodic protection failures or gaps.

The staff finds the applicant's response acceptable for the following reasons:

- A reasonable basis has been established for the staff to conclude that the CLB function(s) of the buried in-scope systems will be maintained based on the number of inspections having been increased from two to six.
- Inspection locations will be informed such that the most highly susceptible and consequential locations will be inspected.
- The cathodic protection for the in-scope buried pipe will prevent corrosion at coating flaw locations.

The staff's concern described in RAI B.2.7-1(6) is resolved.

Based on its audit and review of the application and review of the applicant's response to RAIs B.2.7-1(1) and B.2.7-1(6), the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.7 provides the USAR supplement for the Buried Piping and Tanks Inspection Program.

The staff reviewed the USAR supplement description of the program against the recommended description for this type program, as described in SRP-LR Tables 3.3-2 and 3.4-2, and found that it does not state that preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings and cathodic protection. By letter dated April 20, 2011, the staff issued RAI B.2.7-1(9) requesting that the applicant revise LRA Section A.1.7 to state that preventive measures are in accordance with standard industry practice for maintaining external coatings/wrappings and cathodic protection and to state the number of inspections and frequency of buried in-scope piping.

In its response dated May 24, 2011, the applicant stated that LRA Section A.1.7 was revised to include the requested statements.

The staff finds the applicant's response acceptable because the amended USAR supplement is consistent with the description in SRP-LR Table 3.0-1. The staff's concern described in RAI B.2.7-1(9) is resolved.

The staff also notes that the applicant committed (Commitment No. 3) to enhance the Buried Piping and Tanks Inspection Program prior to the period of extended operation. Specifically, the applicant committed to implement the enhancements described above. In addition, the applicant committed (Commitment No. 44) to cathodically protect the EDG fuel oil storage tanks and in-scope fuel oil and service water piping prior to entering the period of extended operation.

The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Buried Piping and Tanks Inspection Program, the staff determined 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 Commitments No. 3 and No. 44, 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that, as amended by letter dated May 24, 2011, it provides an adequate summary description of the program, as required by 10 CFR 54.21.

3.0.3.2.4 Closed Cooling Water Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.8 describes the existing Closed Cooling Water Chemistry Program as consistent, with an exception, with GALL Report AMP XI.M21, “Closed-Cycle Cooling Water System.” The applicant stated that the purpose of this program is to mitigate damage due to loss of material, cracking, and reduction in heat transfer of components that contain treated water in a closed cooling water system or are served by or connected to a closed cooling water system. The applicant also stated that it controls these aging effects by monitoring and control of corrosion inhibitor concentrations consistent with the current EPRI water chemistry guidelines. The applicant further stated that this program includes corrosion rate measurements at selected locations in the closed cooling water system.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

Although the applicant developed its program based on the recommendations of GALL Report, Revision 1, AMP XI.M21, the staff compared elements one through six of the applicant’s program to the corresponding elements of GALL Report, Revision 2, AMP XI.M21A, “Closed Treated Water Systems,” because GALL Report, Revision 2, represents the current staff position for managing the aging of closed cooling water systems. As discussed in the audit report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL Report, Revision 2, AMP XI.M21A with the exception of the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements. For the “detection of aging effects” element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

GALL Report, Revision 2, AMP XI.M21A recommends that, because the control of water chemistry may not be fully effective, visual inspections should be conducted whenever the system boundary is opened. GALL Report, Revision 2, AMP XI.M21A also recommends that a representative sample of piping and components should be selected based on likelihood of corrosion or cracking and inspected at an interval not to exceed once in 10 years under the “detection of aging effects” program element description. In LRA Section B.2.8 the applicant stated that it will use the One-Time Inspection Program to augment the Closed Cooling Water Chemistry Program. In the exception for this program, the applicant also stated that opportunistic inspections will be conducted when systems are open for maintenance. By letter dated April 20, 2011, the staff issued RAI B.2.8-1 requesting that the applicant clarify whether the Closed Cooling Water Chemistry Program will conduct visual inspections periodically on a representative sample of piping and components or if only one-time inspections will be conducted under the One-Time Inspection Program. If only one-time inspections are planned, the staff requested that the applicant provide technical justification for use of the One-Time Inspection Program rather than a program that includes periodic inspections. If the applicant will conduct periodic inspections, the staff requested that the applicant state whether the inspection results will be reviewed to ensure that a representative sample of piping and components will be inspected at an interval not to exceed 10 years.

In its response dated May 24, 2011, the applicant stated that the Closed Cooling Water Chemistry Program was revised to include an enhancement that requires documentation of the results of periodic inspections of opportunity, performed when components are opened for maintenance, repair, or surveillance. The applicant also stated that the One-Time Inspection Program will no longer supplement the Closed Cooling Water Chemistry Program. The applicant further stated that the Closed Cooling Water Chemistry Program will be enhanced to ensure that a representative sample of piping and components will be inspected on a 10-year interval, with the first inspection taking place prior to entering the period of extended operation.

The staff finds the applicant's response acceptable because periodic inspections on a representative sample of piping and components conducted on a 10-year inspection interval are capable of ensuring that the components will perform their intended function during the period of extended operation. The staff's concerns described in RAI B.2.8-1 are resolved.

As discussed in SER Section 3.3.2.1.1, the applicant initially stated that SRP-LR, item 3.3.1-49, which addresses loss of material due to MIC for components exposed to closed cycle cooling water, was not applicable. In its response dated August 17, 2011, to RAI 3.3.1.49-2, the applicant revised the program description in LRA Section B.2.8 and the USAR supplement description in LRA Section A.1.8 to include MIC as an aging mechanism being managed by the Closed Cooling Water Chemistry Program.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the exception to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.2.8 states an exception to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. The applicant stated that the program does not include performance or functional testing for aging management. The applicant also stated that this program does include corrosion rate measurements via corrosion coupons and opportunistic inspections when systems are open for maintenance.

The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because it conducts corrosion rate measurements and opportunistic inspections that, based on plant-specific operating experience, have been effective in maintaining the intended functions of subject components in closed cooling water systems. The staff finds the program exception acceptable because it is consistent with the current staff position in GALL Report, Revision 2, AMP XI.M21A, which recommends periodic inspections rather than performance and functional testing and states that the program may also include corrosion monitoring with coupon testing.

Enhancement. The applicant enhanced its Closed Cooling Water Chemistry Program as a result of its response to RAI 2.3.3.18-4 dated November 23, 2011, to include sampling the CCW radiochemistry on a weekly interval to verify the integrity of the letdown coolers and seal return coolers. The staff noted that the applicant implemented this enhancement to address recurring tube cracking due to flow induced vibration of the letdown coolers in the makeup and purification system. The staff also noted that, as discussed in SER Section 2.3.3.18.2, the applicant had demonstrated that sampling the CCW radiochemistry was an effective means to identify leakage from letdown cooler tube cracks prior to challenging the CLB function of the coolers. The staff reviewed this enhancement and finds it acceptable because, when implemented, it can be an effective means to verify the integrity of the letdown and seal return coolers, as previously demonstrated at the site.

Based on its audit and review of the applicant's response to RAI B.2.8-1 and RAI 2.3.3.18-4, the staff finds that elements one through six of the applicant's Closed Cooling Water Chemistry Program, with acceptable exception and enhancement, are consistent with the corresponding program elements of GALL Report, Revision 2, AMP XI.M21A and, therefore, are acceptable.

Operating Experience. LRA Section B.2.8 summarizes operating experience related to the Closed Cooling Water Chemistry Program. The applicant stated that this program incorporates the EPRI closed cooling water guidelines and lessons learned from operating experience. The applicant stated that a 2008 review identified that the closed cooling water sulfate concentrations were historically above the current EPRI guideline specifications. The applicant also stated that the corrosion coupons corrosion rate trends indicated that this did not enhance general corrosion, and the sulfate monitoring frequency was increased until sulfate concentrations were returned to less than 150 parts per billion (ppb) in 2009. The applicant further stated that a 2008 evaluation of nitrite levels in the EDG jacket water system discovered concentrations outside the station specifications but less than the EPRI action levels. The applicant stated that the controlling chemistry procedures were enhanced to ensure actions were included when exceeding the station upper limits.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrated that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.8 provides the USAR supplement for the Closed Cooling Water Chemistry Program. The staff reviewed this USAR supplement description of the program, as amended in the response to RAI B.2.8-1, RAI 3.3.1.49-2, and supplemental response to RAI 2.3.3.18-4, and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, and 3.4-2.

The staff also noted that the applicant committed (Commitment No. 32) to enhance the Closed Cooling Water Chemistry Program prior to entering the period of extended operation. Specifically, the applicant committed to document the results of periodic inspections, inspect a representative sample of piping and components on a 10-year interval, and sample the CCW radiochemistry on a weekly interval.

The staff determined that the information in the USAR supplement as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Closed Cooling Water Chemistry Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 External Surfaces Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.15 describes the existing External Surfaces Monitoring Program as consistent, with enhancements, with GALL Report AMP XI.M36, "External Surfaces Monitoring." The applicant stated that the External Surfaces Monitoring Program is a condition monitoring program consisting of periodic visual inspections and surveillance activities to manage loss of material for the external surfaces of aluminum, copper alloy (copper, brass, bronze, and copper-nickel), stainless steel (including CASS), and steel (carbon and low-alloy steel and cast iron) components. The program will also manage loss of material for the internal surfaces of components where the internal environment is the same as the external environment. The applicant also stated that the program will manage elastomers and polymers exposed to indoor uncontrolled and outdoor air for cracking, change in material properties, and loss of material due to wear. The applicant further stated that the program is applied to manage loss of heat transfer for the control room emergency ventilation system air-cooled condensing unit cooling coil tubes and fins and SBODG radiator tubes and fins exposed to an outdoor air environment.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M36. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.M36. The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with the enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.15 states an enhancement to the "scope of program" program element. The applicant stated that systems that credit the External Surfaces Monitoring Program for license renewal but do not have Maintenance Rule, 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," intended functions will be added to the scope of the program.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M36. The staff finds the applicant's enhancement acceptable because it provides the management of aging effects to additional system components that are within the scope of license renewal but which do not have Maintenance Rule intended functions.

Enhancement 2. LRA Section B.2.15 states an enhancement to the “detection of aging effects” program element. The applicant stated that surfaces that are either inaccessible or not readily visible during either plant operations or RFOs, such as surfaces that are insulated, will be inspected opportunistically during the period of extended operation. The applicant also stated that surfaces that are accessible will be inspected at least once per refueling cycle.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M36, which states that inspections are performed at least once per refueling cycle but that surfaces that are not readily accessible or are insulated are inspected when they are made accessible, at intervals that ensure the component’s function is maintained. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it provides inspection opportunities that will allow for the detection of aging effects of in-scope components prior to the loss of intended functions consistent with the recommendations in GALL Report AMP XI.M36 for inspecting accessible, inaccessible, and insulated surfaces.

Enhancement 3. LRA Section B.2.15 states an enhancement to the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements. The applicant stated that the program will be supplemented by the One-Time Inspection Program, which will perform inspections and surveillances of elastomers and polymers that are not replaced on a set frequency or interval. The applicant also stated that the acceptance criteria for these components will consist of no unacceptable visual indications of cracks or discoloration that would lead to loss of function prior to the next scheduled inspection.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36. The staff noted that the applicant’s program appropriately identifies acceptance criteria for visual inspection of in-scope polymeric components; however, the program does not include physical manipulation of polymeric components. The LRA states that physical manipulation of elastomer and polymeric components is included in the One-Time Inspection Program. GALL Report AMP XI.M36 recommends both visual inspections and manual or physical manipulations to manage aging for polymeric components. It is not clear to the staff how a one-time manual manipulation is adequate to manage aging for polymeric components. By letter dated April 20, 2011, the staff issued RAI 3.3.2.2.5-1 requesting that the applicant do the following:

- provide an alternative program to manage aging for elastomers and polymers given that use of the One-Time Inspection Program is not consistent with the GALL Report recommendations for managing hardening and loss of strength for elastomeric components
- provide an assessment of the AMR items containing similar material, environment, and aging effect combinations that might be affected and revise these items to ensure an appropriate AMP is credited
- revise the External Surfaces Monitoring Program to include physical manipulation of elastomeric materials

- state the basis for how hardening and loss of strength occurring in the interior surfaces of elastomeric components will be effectively detected with only an inspection of the exterior surface of the component

In its response dated May 24, 2011, the applicant stated the following:

- Elastomers were removed from the scope of the One-Time Inspection Program and added to the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, which includes periodic inspections and physical manipulation of elastomers.
- An assessment of AMR items was performed, and the elastomer items were revised to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage hardening and loss of strength for the internal surfaces of elastomers and to credit the External Surfaces Monitoring Program to manage aging for the exterior surface.
- The External Surfaces Monitoring Program will be supplemented by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, which includes physical manipulation, to manage aging for elastomers,

The staff finds the applicant's response unacceptable because the applicant did not revise the External Surfaces Monitoring Program to include physical manipulation of elastomers; therefore, the applicant is proposing to visually inspect the internal and external surfaces of elastomers but to only physically manipulate the internal surface. The GALL Report recommends visual inspections and physical manipulation of both the internal and external surfaces of elastomeric components to manage aging. In addition, GALL Report AMP XI.M36 recommends that at least 10 percent of the available surface be physically manipulated during an inspection; however, the applicant did not state what percentage of the elastomer would be physically manipulated. By letter dated July 12, 2011, the staff issued RAI 3.3.2.2.5-2 requesting that the applicant revise the External Surfaces Monitoring Program to include physical manipulation of elastomers and state the minimum available surface area that will be physically manipulated during inspections.

In its response dated August 17, 2011, the applicant revised the External Surfaces Monitoring Program to include physical manipulation of the external surfaces of elastomers. The applicant also revised the LRA to state that at least 10 percent of the available surface would be physically manipulated as part of program. In addition, the applicant revised this enhancement to state that the External Surfaces Monitoring Program will monitor cracking, change in material properties (hardening and loss of strength), and loss of material due to wear for elastomers and polymers through a combination of visual and manual or physical manipulations. The applicant further revised the LRA to state that acceptance criteria for these components will include no unacceptable visual indications of cracks or discoloration and no hardening as evidenced by loss of suppleness during manipulation.

The staff finds the applicant's response acceptable because the applicant revised the LRA to manage both the internal and external surfaces of elastomers using both visual inspections and physical manipulation and stated that physical manipulation will be performed of at least 10 percent of the available surface. Therefore, the AMP will be capable of detecting aging in elastomers and is consistent with the GALL Report. The staff's concerns described in RAIs 3.3.2.2.5-1 and 3.3.2.2.5-2 are resolved.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and noted that management of elastomers for cracking, loss of material, and change in material properties was added to the program in GALL Report, Revision 2. The staff also noted that GALL Report, Revision 2, AMP XI.M36 states that flexible polymeric materials should be managed for aging using visual inspections and physical manipulation of both the internal and external surfaces and that the parameters monitored should include cracking, discoloration, and loss of suppleness. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL Report Revision 2 for elastomers.

Enhancement 4. LRA Section B.2.15 states an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. The applicant stated that the program will be enhanced to include inspection and surveillance of the control room emergency ventilation system air-cooled condensing unit cooling coil tubes and fins and the SBODG radiator tubes and fins for visible evidence of external surface conditions that could result in a reduction in heat transfer. Acceptance criteria for these components will consist of no unacceptable visual indications of fouling.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and noted that the GALL Report AMP does not include management of reduction of heat transfer. However, the staff also noted that the program includes periodic visual inspections of metallic components for loss of material and that fouling can also be identified by visual inspection. On the basis of its review, the staff finds this enhancement acceptable because the visual inspections performed by the program are an acceptable method of identifying fouling that could lead to reduction of heat transfer.

Enhancement 5. LRA Section B.2.15 states an enhancement to the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. The applicant stated that the program will be enhanced to manage cracking of copper alloy with greater than 15 percent Zn and stainless steel components exposed to outdoor air using inspections and walkdowns for evidence of leakage. The applicant also stated that acceptance criteria for surfaces will consist of no unacceptable visual indications of cracks that could lead to loss of function prior to the next inspection.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and noted that the scope of the program was revised to address aging management of all types of metallic and polymeric materials, and cracking was added as an aging effect for stainless steel components exposed to outdoor air in GALL Report, Revision 2. The staff also noted that GALL Report, Revision 2, AMP XI.M36 states that visual inspection for leakage is an acceptable method to manage cracking for stainless steel components exposed to outdoor air. The staff further noted that cracking of copper alloy with greater than 15 percent Zn components exposed to outdoor air would be manifested in the same manner as for stainless steel components exposed to outdoor air and, therefore, can be detected using the same inspection methods as for stainless steel components. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, the program will manage additional materials for cracking using inspection methods that are consistent with the recommendations in the GALL Report, Revision 2.

Enhancement 6. LRA Section B.2.15, as amended by letter dated August 17, 2011, states an enhancement to the "parameters monitored or inspected" and "acceptance criteria" program elements. This enhancement was added as a response to the staff's finding from the scoping, screening, and aging management license renewal inspection conducted April 25-May 13, 2011. During the inspection, the staff noted that the applicant's walkdown checklists did not include all applicable aging effects, specific acceptance criteria, or retention requirements. In this enhancement, the applicant stated that inspection and walkdown documentation will be enhanced to include inspection parameters and acceptance criteria for polymers, elastomers, and metallic components. The applicant also stated that this documentation will be retained in plant records.

During the followup inspection conducted August 22–August 26, 2011, the staff noted that the applicant revised the walkdown checklists to include the following inspection parameters:

- for metallic components—corrosion and material wastage; leakage from or onto external surfaces; worn, flaking, or oxide-coated surfaces; corrosion stains on thermal insulation; protective coating degradation (cracking, flaking, and blistering); leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides; and fouling (buildup of dirt or other foreign material) for cooling coil/radiator tubes and fins
- for polymers and elastomers—surface cracking, crazing, scuffing, and dimensional change (e.g., "ballooning" and "necking"); discoloration; exposure of internal reinforcement for reinforced elastomers; hardening as evidenced by a loss of suppleness during manipulation where the component and material are appropriate to manipulation

The staff also noted that the applicant added the acceptance criteria of no unacceptable visual indications of cracking and loss of material that would lead to loss of function prior to the next scheduled inspection for metallic components. For non-metallic components, the applicant added the acceptance criteria that no unacceptable visual indications of loss of material, cracks, or discoloration that would lead to loss of function prior to the next scheduled inspection and no hardening as evidenced by a loss of suppleness during manipulation. For cooling coil and radiator tubes and fins, the applicant added the acceptance criteria that no unacceptable visual indications of fouling (buildup of dirt or other foreign material) that would lead to loss of function prior to the next scheduled inspection.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and confirmed that the inspection parameters and acceptance criteria added to the walkdown checklists are consistent with the recommendations in the GALL Report AMP. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, the inspection parameters and acceptance criteria will be consistent with the recommendations in the GALL Report.

Based on its audit and review of the applicant's responses to RAIs 3.3.2.2.5-1 and 3.3.2.2.5-2, the staff finds that elements one through six of the applicant's External Surfaces Monitoring Program are consistent with the corresponding program elements of GALL Report AMP XI.M36 and, therefore, are acceptable.

<u>Operating Experience</u>. LRA Section B.2.15 summarizes operating experience related to the External Surfaces Monitoring Program. The applicant stated that an internal review of plant-specific operating experience, through a search of plant Corrective Action Program documents from 2002 and later, revealed that component leakage, damage, and degradation are routinely identified by the inspections and surveillance activities within the program. The applicant also stated that the inspections conducted within the program have routinely led to

corrective actions taken in a timely manner and that no loss of pressure boundary integrity has occurred that could have been attributed to aging effects of in-scope components. The applicant further stated that various Corrective Action Program items address the finding and correction of minor rust and leakage identified during inspections. The applicant also stated that information is reported in the quarterly plant health reports to provide information used in trending and to assess plant health and condition.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.15 provides the USAR supplement for the External Surfaces Monitoring Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2. The staff also noted that the applicant committed (Commitment No. 8) to enhance the External Surfaces Monitoring Program prior to entering the period of extended operation. Specifically, the applicant committed to the following enhancements:

- add systems that credit the program for license renewal but do not have Maintenance Rule intended functions to the scope of the program
- perform opportunistic inspections of surfaces that are inaccessible or not readily visible during normal plant operations or RFOs, such as surfaces that are insulated and perform inspections of accessible surfaces at least once per refueling cycle
- perform inspections and surveillances of, and specify acceptance criteria for, elastomers and polymers for evidence of cracking, loss of material due to wear, and change in material properties (hardening and loss of strength)
- perform inspections of, and specify acceptance criteria for, the control room emergency ventilation system air-cooled condensing unit cooling coil tubes and fins and the SBODG radiator tubes and fins for visible evidence of external surface conditions that could result in a reduction in heat transfer
- perform inspections and specify acceptance criteria for cracking of copper alloys with greater than 15 percent Zn and stainless steel components exposed to outdoor air
- include inspection parameters and acceptance criteria for polymers, elastomers, and metallic components in system inspection and walkdown documentation and retain system inspection and walkdown documentation in plant records

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 8, prior to the period of extended operation, would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Fatigue Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.16 describes the existing Fatigue Monitoring Program as consistent, with enhancements, with GALL Report AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The applicant stated that its program manages fatigue of primary and secondary components—including the RV, reactor internals, pressurizer, and SGs—by tracking thermal cycles as required by TS 5.5.5, "Component Cyclic or Transient Limit." The program uses the systematic counting of plant transient cycles to ensure that the design cycles are not exceeded, thereby ensuring that component fatigue usage limits are not exceeded. The program periodically updates the cycle counts and takes corrective action when the accumulated cycles approach the design cycles to ensure the analyzed number of cycles is not exceeded. Corrective action may include update of the fatigue usage calculation, such that any reanalysis will use the version of ASME Code or an alternative (e.g., Code Case), as approved by the NRC, to determine a valid cumulative usage factor (CUF). The applicant also noted that it has addressed the effects of the reactor coolant environment on component fatigue life by assessing the environmental impact on a sample of critical components identified in NUREG/CR-6260, in accordance with guidance from NUREG/CR-6583 and NUREG/CR-5704.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP X.M1. As discussed in the audit report, the staff determined that each element of the applicant's program was not consistent with the corresponding elements of GALL Report AMP X.M1, including the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. For these six elements, as well as the "corrective actions" program element, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

In its review of the applicant's Fatigue Monitoring Program, the staff noted that the program is primarily based on tracking cycle counts and comparing them with design limits on fatigue transients to manage cumulative fatigue damage of select components. The staff noted that the applicant's program tracks thermal cycles as required by TS 5.5.5, "Component Cyclic or

Transient Limit," for the 14 original RCS design transients listed in USAR Table 5.1-8 along with additional transients as identified in the LRA Table 4.3-1. The staff also noted that the program's scope includes a limited set of components that have been evaluated for subject to environmental effects on fatigue usage, consistent with the recommendations of GALL Report AMP X.M1.

During its onsite audit, the staff reviewed the applicant's program implementation procedure for tracking transients, TS 5.5.5, USAR Table 5.1-8, and LRA Table 4.3-1, and noted that transient descriptions and cycle counts were not consistent among these documents. In order for the staff to verify whether the transients are being monitored and are fatigue-significant, the information between these documents should be consistent. The staff also noted that TS 5.5.5, Amendment 279, in the applicant's license, was titled "Allowable Operating Transient Cycles [AOTC] Program," which is not consistent with the description provided in LRA Section B.2.16 for "Component Cyclic or Transient Limit."

By letter dated April 20, 2011, the staff issued RAI B.2.16-1 requesting that the applicant clarify and reconcile any discrepancies among the program implementation procedure, TS 5.5.5, USAR Table 5.1-8, and LRA Table 4.3-1, with respect to the transient descriptions, transients monitored, and cycle limits. The staff also asked the applicant to clarify and provide justification for any transients that are required to be monitored by TS 5.5.5 and USAR Section 5 but are not monitored by the Fatigue Monitoring Program.

In its response dated June 3, 2011, the applicant stated that it conducted a review of its AOTC Program, Section 5 of the USAR (including Table 5.1-8), the RCS Functional Specification, and LRA Table 4.3-1 and identified several inconsistencies in the AOTC Program. The applicant stated that USAR Table 5.1-8 and LRA Table 4.3-1 were compared to the transients and descriptions provided in the RCS Functional Specification, which is the primary source of design transients for the Babcock and Wilcox (B&W)-supplied RCS components. USAR Table 5.1-8 currently lists only the 14 original NSSS design transients for the RCS, whereas the RCS Functional Specification now consists of 25 transients that include additional transients identified over the life of the plant. Furthermore, the applicant stated that the estimated cycles in USAR Table 5.1-8 were only historical data and were not consistent with LRA Table 4.3-1 actual data. Thus, the applicant provided proposed changes to USAR Table 5.1-8 to include all transients listed in the RCS Functional Specification and justification for transients that will not be monitored. LRA Table 4.3-1 was revised to be consistent with the transient data from its proposed USAR Table 5.1-8, which aligns to the transient descriptions from the RCS Functional Specification and the AOTC Program. The applicant further stated that it revised LRA Sections A.1.16 and B.2.16 to show the title of its TS 5.5.5 as "Allowable Operating Transient Cycles Program."

The staff noted that the proposed USAR Table 5.1-8 has been expanded to include all 25 transients, including the associated design cycles, in the RCS Functional Specification and the applicable ASME Code classification for each transient, which clarifies the fatigue significance of each transient. The proposed changes also include technical justification for those transients not requiring monitoring under its program. The staff noted that consistency among the applicant's documentation ensures that all transients that cause cycle strain will be monitored and that the ASME Code Limit of 1.0 is not exceeded, consistent with the recommendation of GALL Report AMP X.M1.

Based on its review, the staff finds the applicant's response to RAI B.2.1.16-1 acceptable because the applicant has reconciled discrepancies between its program implementation procedure (AOTC), USAR Table 5.1-8, and LRA Table 4.3-1, with respect to the transient descriptions, transients monitored, and all cycle limits. Additionally, the applicant is monitoring all transients that cause cyclic strains that are significant contributors to the fatigue usage factor and have been included in the applicant's fatigue analyses, consistent with the recommendations in the "parameters monitored/inspected" program element of GALL Report AMP X.M1. The staff's concern described in RAI B.2.16-1 is resolved.

GALL Report AMP X.M1 recommends the evaluation of reactor water environment on fatigue life for a sample set of components, which should include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the RCPB if they may be more limiting than those considered in NUREG/CR-6260. When reviewing the "scope of program" program element, the staff noted that the applicant did not identify or include any additional component locations other than those from NUREG/CR-6260 for the evaluation of the effects of reactor water environment, as recommended in GALL Report AMP X.M1.

By letter dated April 20, 2011, the staff issued RAI B.2.16-2 requesting that the applicant confirm or justify that the plant-specific locations listed in LRA Table 4.3-2 for environmentally-assisted fatigue (EAF) analyses are the most limiting locations for the plant (beyond the generic components identified in the NUREG/CR-6260 guidance). If these locations are not bounding, the staff requested the applicant to clarify the locations that require an EAF analysis, provide the basis for such analysis, and explain the actions that will be taken for these additional locations.

In its response, dated June 3, 2011, the applicant stated that its EAF evaluation of plant-specific locations given in LRA Table 4.3-2 is consistent with the NUREG/CR-6260. The applicant also discussed its basis for selecting the pressurizer surge line piping as a location to evaluate the effects of reactor water environment. The staff finds the applicant's selection to evaluate the pressurizer surge line piping reasonable because the temperature differential in this piping as a result of thermal stratification causes it to be a fatigue-sensitive location in the RCS during normal operation. The applicant stated that it compiled a listing of all design CUFs, which were multiplied by a maximum EAF correction factor (F_{en}) to determine the bounding EAF CUF (CUF_{en}) values. The applicant provided the following bounding F_{en} for a PWR reactor coolant environment and the associated NUREG/CR report that was used for each value:

- low alloy steel—F_{en} max of 2.54 (NUREG/CR-6583)
- carbon steel—F_{en} max of 1.74 (NUREG/CR-6583)
- stainless steel—F_{en} max of 15.35 (NUREG/CR-5704)
- nickel-based alloy—F_{en} max of 4.52 (NUREG/CR-6909 and associated with new design curve)

The staff reviewed the aforementioned NUREG/CR reports and confirmed that for a PWR reactor water environment the F_{en} factors used by the applicant are bounding and conservative. As a result, the applicant provided a list of additional locations not evaluated in its LRA for EAF for which the bounding estimates of CUF_{en} exceeded the limit of 1.0. Therefore, the applicant amended LRA Section B.2.16 to include an enhancement to the "scope of program" program element to evaluate additional plant-specific component locations in the RCPB that may be more limiting than those considered in NUREG/CR-6260. The applicant committed (Commitment No. 42) to implement this enhancement prior to April 22, 2016. The staff's review of this additional enhancement is documented below.

The staff noted that the use of NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials," for nickel-alloy materials, as stated in Commitment No 42, is acceptable because it is consistent with the recommendation in GALL Report AMP X.M1.

Based on its review, the staff finds the applicant's response to RAI B.2.16-2 and Commitment No. 42 acceptable for the following reasons:

- The applicant will evaluate its plant-specific location to determine whether the NUREG/CR-6260 locations are the limiting locations for its plant.
- If more limiting locations are identified, the applicant will evaluate the effects of the reactor coolant environment for the most limiting location.
- The applicant will use the methodology consistent with NUREG/CR-6909 in the evaluation of limiting component consisting of nickel alloy.
- Commitment No. 42 is consistent with the recommendations in SRP-LR Sections 4.3.2.2, 4.3.3.2, and GALL Report AMP X.M1, to consider environmental effects for additional plant-specific locations.

The staff's concern described in RAI B.2.16-2 is resolved.

The applicant stated that counting plant transient cycles in its program ensured the component fatigue usage limits are not exceeded as required under the "preventive actions" program element of GALL Report AMP X.M1. The staff noted that, under the counting activity, there is a potential to exceed the fatigue usage design limit unless the program also ensures that the severity of actual transients is bounded by the severity assumed in the design analyses. Furthermore, during its audit, the staff noted that the applicant's implementation procedure indicated that evaluation will be performed when the count for a transient reaches a certain fraction of the corresponding "design cycles"; however, the staff noted that the specific actions that would be taken and the associated timeframe were not discussed. The "detection of aging effects" program element of GALL Report AMP X.M1 recommends that the program provides for updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached.

By letter dated April 20, 2011, the staff issued RAI B.2.16-3 requesting the applicant do the following:

- provide the details and basis for the process used to verify that the severity of an actual transient is bounded by the severity of the design transient
- confirm that the severity of all transients that have occurred to date, since initial plant operation, have been bounded by the design severity and, if there have been instances where the actual severity exceeded the design severity, discuss the actions taken to assure that the Code design limit has not been exceeded and that the fatigue analysis remains valid
- confirm that the "design cycles" limits monitored by the Fatigue Monitoring Program, as listed in the LRA Table 4.3-1, are those used in various current or updated fatigue analyses
- clarify the actions or measures that will be taken as part of the program if the actual transient severity exceeds the design severity and if the actual cycle count approaches or exceeds the number of cycles

In its response, dated June 3, 2011, the applicant stated that its RCS components are designed to withstand the operating transients as defined (i.e., maximum rates of change of temperatures, pressures, flows, etc.) in its RCS Functional Specification. In addition, the Fatigue Monitoring Program, which is consistent with the RCS Functional Specification, counts the actual number of transient cycles. The applicant confirmed that it determines a transient classification by reviewing the operational data and comparing it to the event data as defined in the RCS Functional Specification. The applicant also stated that clarification is needed in its program relative to actions taken if an allowable cycle limit is approached. Therefore, LRA Section B.2.16 was amended to include a new enhancement to the "detection of aging effects" program element. The new enhancement states that for any transient whose cycles are projected to exceed the allowable cycle limit by the end of the next plant operating cycle, the program will require an update of the fatigue usage calculation for the affected component(s). In addition, when the number of accrued cycles is within 75 percent of the allowable cycle limit for any transient, a condition report will be generated. The staff's review of this additional enhancement is documented below. In addition, the applicant has committed (Commitment No. 9) to implement the enhancement prior to the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.2.16-3 and Commitment No. 9, as amended by letter dated June 3, 2011, acceptable for the following reasons:

- The applicant's procedure compares the parameters in its RCS Functional Specification used to define design transients with the data that is observed during plant operation, which is consistent with the "preventive actions" program element of GALL Report AMP X.M1 to ensure fatigue usage does not exceed 1.0.
- The applicant's program has identified and incorporated modified or additional transients during the plant operating history in its revised USAR Table 5.1-8 and LRA Table 4.3-1, which is consistent with the recommendations in the "parameters monitored/inspected" program element of GALL Report AMP X.M1 to include all plant design transients that cause cyclic strains, which are significant contributors to the fatigue usage factor.
- The applicant's proposed enhancement, to include a provision for updating the fatigue usage calculation if 75 percent of allowable cycle limit is approached, is consistent with the recommendations in the "detection of aging effects" program element of GALL Report AMP X.M1 to provide for updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached.

The staff's concern described in RAI B.2.16-3 is resolved.

LRA Section B.2.16 states that the program is consistent, with enhancements, with GALL Report AMP X.M1. The staff noted that the use of cycle counting in GALL Report AMP X.M1 is applicable for CUF analyses (e.g., ASME Code Section III CUF analyses and environmentally-assisted CUF analyses). Therefore, the use of cycle counting to manage non-CUF type analyses, such as the flaw growth of either a postulated or existing macro flaw, is not applicable to the recommendations by GALL Report AMP X.M1. The applicant credits its Fatigue Monitoring Program to use cycle-counting for the fatigue flaw growth time-limited aging analyses (TLAAs) described in LRA Sections 4.7.1, 4.7.4, 4.7.5.1, and 4.7.5.2 without enhancements to the applicable program elements. It is also not clear if the applicant's basis for using cycle counting is captured in the applicable documents (e.g., TS, USAR, and cycle-counting procedures) to describe the management of fatigue flaw growth during the period of extended operation.

By letter dated April 20, 2011, the staff issued RAI B.2.16-7, asking the applicant to identify the transients and their respective number of cycles assumed in the non-CUF type analyses. The staff also asked the applicant to justify the use of cycle counting for the TLAAs, dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), that credit the Fatigue Monitoring Program without an update to the applicable CLB documents and the inclusion of enhancements to the applicable program elements

In its response dated June 3, 2011, the applicant stated that only those TLAA described in LRA Section 4.7 (leak-before-break in Section 4.7.1.1, high-pressure injection (HPI) thermal sleeves in Section 4.7.4, and SG flaw evaluation in Section 4.7.5.2) credited the Fatigue Monitoring Program (cycle counting) for managing the TLAA in accordance with 10 CFR 54.21(c)(1)(iii). Furthermore, the applicant also stated that it has revised the disposition of the TLAAs in LRA Sections 4.7.1.1, 4.7.4, and 4.7.5.2, to 10 CFR 54.21(c)(1)(i) or that it is not a TLAA, to eliminate reliance on management by the Fatigue Monitoring Program. By letter dated October 31, 2011, the applicant amended LRA Section 4.7.4 to disposition this TLAA in accordance with 10 CFR 54.21c)(1)(iii), the effects of cracking on the makeup nozzle thermal sleeve will be managed by the ISI Program through the period of extended operation. The applicant further stated that its Fatigue Monitoring Program is no longer used to manage non-CUF type analyses. The staff evaluations of the applicant's revised disposition of the TLAAs in LRA Sections 4.7.1.1, 4.7.4, and 4.7.5.2 are documented in the respective SER Sections in 4.7.

Based on its review, the staff finds the applicant's response to RAI B.2.16-7 acceptable because, consistent with GALL Report AMP X.M1, the applicant's Fatigue Monitoring Program is credited to manage CUF TLAAs and is not relied upon to manage non-CUF analyses. The staff's concern described in RAI B.2.16-7 is resolved.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective action" program elements associated with enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.16 states an enhancement to the "preventive actions," "monitoring and trending," and "acceptance criteria" program elements. The applicant stated that the enhancement adds options to the program implementation to deal with fatigue locations, including NUREG/CR-6260 locations, projected to exceed the CUF of 1.0 (design limit). More specifically, for such fatigue locations, the Fatigue Monitoring Program will be enhanced to implement one or more of the following options:

(1) refine the fatigue analyses to determine valid CUFs less than 1.0 using an NRC-approved version of the ASME Code or an alternative (e.g., NRC-approved Code Case)

(2) manage the effects of aging due to fatigue at the affected locations by an inspection program that will be reviewed and approved by the NRC (e.g., periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC)

(3) repair or replace the affected locations

The staff noted that the objective of GALL Report AMP X.M1 is to ensure that the fatigue usage does not exceed the Code design limit during period of extended operation; therefore, it was not clear how the sole use of option 2 above, of the aging due to fatigue by an inspection program, is consistent with GALL Report AMP X.M1 to prevent cumulative fatigue usage from exceeding the Code design limit.

By letter dated April 20, 2011, the staff issued RAI B.2.16-4, asking the applicant to provide the basis for using an inspection program, as an option, to manage fatigue usage during period of extended operation, and to justify that its use is consistent with GALL Report AMP X.M1. In addition, the applicant was asked to clarify if the options described in the enhancement are meant to be corrective actions or preventive actions.

In its response, dated June 3, 2011, the applicant stated that, in lieu of responding to the individual subcomponents of the staff's questions, Commitment No.9 and LRA Section B.2.16 are revised to completely delete the subject enhancement and include a new enhancement for the "acceptance criteria" program element as follows, which will be implemented prior to the period of extended operation: "Establish an acceptance criterion for maintaining the cumulative fatigue usage below the Code design limit of 1.0 through the period of extended operation, including environmental effects where applicable."

The staff noted that options 1 and 3 in the applicant's subject enhancement are corrective actions taken to prevent the usage factor from exceeding the design code limit during the period of extended operation, which are consistent with the "corrective actions" program element of GALL Report AMP X.M1. During its audit, the staff confirmed that the "corrective actions" program element of the applicant's program is consistent with the recommendations in GALL Report AMP X.M1.

The "acceptance criteria" program element of GALL Report AMP X.M1 states that the acceptance criterion is maintaining the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. The applicant's enhancement, as amended by letter dated June 3, 2011, is consistent with the recommendations in GALL Report AMP X.M1. Therefore, the staff finds it acceptable that the applicant amended LRA Section B.2.16 to delete the subject enhancement described in the staff's RAI because the applicant's program contains an acceptance criterion and corrective actions consistent with the recommendations in GALL Report AMP X.M1.

Based on its review, the staff finds the applicant's response to RAI B.2.16-4 acceptable because the revised enhancement is consistent with the objective of GALL Report AMP X.M1 to ensure that the fatigue usage does not exceed the Code design limit during period of extended operation. Additionally, the applicant's program incorporates an acceptance criterion and corrective actions, consistent with GALL Report AMP X.M1. The staff's concern described in RAI B.2.16-4 is resolved.

Based on its review, the staff finds the revised enhancement to the "acceptance criteria" program element acceptable because the applicant will establish an acceptance criterion for maintaining the cumulative fatigue usage below the Code design limit, which is consistent with GALL Report AMP X.M1.

Enhancement 2. LRA Section B.2.16 states an enhancement to the "parameters monitored or inspected" program element. The applicant stated that it will enhance the Fatigue Monitoring Program to monitor any transient where the 60-year projected cycles were used in an EAF evaluation and to establish an administrative limit that is equal to or less than the 60-year projected cycles.

The staff reviewed this enhancement against the affected program element in GALL Report AMP X.M1. It is not clear to the staff why an administrative limit is to be established only for those transients used in the EAF evaluations. The staff also noted that establishing a limit solely on counting the 60-year projected cycles, without referencing the CUF value, may not ensure that the acceptance criterion for CUF will be met through the period of extended operation—in particular, if the actual cycles analyzed are less than the design limit or projected cycles as listed in the LRA Table 4.3-1.

By letter dated April 20, 2011, the staff issued RAI B.2.16-5, requesting the applicant to justify why establishing the administrative limit only for those transients used in an EAF evaluation is adequate to ensure that the acceptance criterion for CUF will be met through the period of extended operation. The staff also asked the applicant to justify why establishing the administrative limit solely on the basis of 60-year projected cycles without reference to the actual analyzed cycles is sufficient to ensure that the acceptance criterion will be met through the period of extended operation, consistent with GALL Report AMP X.M1.

In its response, dated June 3, 2011, the applicant stated that, in lieu of responding to the individual subcomponents of the RAI B.2.16-5, Commitment No. 9, and LRA Section B.2.16 are revised to completely delete the subject enhancement and include a new enhancement for the "acceptance criteria" program element as follows: "Establish an acceptance criterion for maintaining the cumulative fatigue usage below the Code design limit of 1.0 through the period of extended operation, including environmental effects where applicable."

The staff's evaluation of this revised enhancement is provided in Enhancement 1, as documented above.

Based on its review, the staff finds the applicant's response to RAI B.2.16-5 acceptable because the applicant's program will establish an acceptance criterion to maintain cumulative fatigue usage, including environmental effects where applicable, below the Code Design limit of 1.0 through the period of extended operation. Additionally, the applicant's enhancement, as amended by letter dated June 3, 2011, is consistent with GALL Report AMP X.M1, as described above. The staff's concern described in RAI 2.16-5 is resolved.

Enhancement 3. In response to RAIs B.2.16-2, B.2.16-3, B.2.16-4, and B.2.16-5, the applicant amended LRA Section B.2.16 to modify its enhancements. LRA Section B.2.16, as amended by letter dated June 3, 2011, states an enhancement to the "scope of program" program element. The applicant stated that it will enhance the Fatigue Monitoring Program as follows:

> Evaluate additional plant-specific component locations in the reactor coolant pressure boundary that may be more limiting than those considered in NUREG/CR-6260. This evaluation will include identification of the most limiting fatigue location exposed to reactor coolant for each material type (i.e., CS, LAS, SS, and NBA) and that each bounding material/location will be evaluated for the effects of the reactor coolant environment on fatigue usage. Nickel-based alloy items will be evaluated using NUREG/CR-6909. This evaluation will be submitted to the NRC one year prior to the period of extended operation.

The applicant committed (Commitment No. 42) to implement this enhancement prior to April 22, 2016. As described above in the staff's evaluation of RAI B.2.16-2, the applicant compiled a listing of RCS pressure boundary locations, by material type, with CUF_{en} values greater than 1.0 that are not evaluated as NUREG/CR-6260 locations.

The “scope of program” program element of GALL Report AMP X.M1 states that applicants should include, for a set of sample RCS components, fatigue usage calculations that consider the effects of the reactor water environment, which include locations identified in NUREG/CR-6260 and additional plant-specific component locations in the RCPB if they may be more limiting than those considered in NUREG/CR-6260. The staff noted that the applicant considered those generic locations identified in NUREG/CR-6260 in LRA Section 4.3.4, and the staff’s evaluations of these TLAAs are documented in SER Section 4.3.4. In addition, the applicant’s program is enhanced to evaluate additional locations beyond those in NUREG/CR-6260 for the effects of reactor water environment that may be more limiting.

Based on its review, the staff finds this enhancement to the “scope of program” program element acceptable because, consistent with GALL Report AMP X.M1, the applicant considered those generic locations identified in NUREG/CR-6260 and committed (Commitment No. 42) to enhance its program to consider plant-specific component locations in the RCPB that may be more limiting than those considered in NUREG/CR-6260.

Enhancement 4. LRA Section B.2.16, as amended by letter dated June 3, 2011, states an enhancement to the “detection of aging effects” program element. The applicant stated that it will enhance the Fatigue Monitoring Program, prior to the period of extended operation, as follows:

> Provide for updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached. When the number of accrued cycles is within 75 [percent] of the allowable cycle limit for any transient, a condition report will be generated. For any transient whose cycles are projected to exceed the allowable cycle limit by the end of the next plant operating cycle (Davis-Besse operating cycles are normally two years in duration), the program will require an update of the fatigue usage calculation for the affected component(s).

The “detection of aging effects” program element of GALL Report AMP X.M1 states the program provides for updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached or in cases where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components have been modified. The staff noted that the applicant’s enhancement ensures that the program will detect if the accrued cycles approaches the allowable limit or if the cumulative fatigue usage approaches the Code Design limit of 1.0.

Based on its review, the staff finds the enhancement acceptable because the applicant’s program, consistent with the recommendations of GALL Report AMP X.M1, has measures to ensure that fatigue usage calculations are updated, as needed, (1) prior to the accrued cycles exceeding the allowable cycle limit, (2) the Code Design limit of 1.0 being exceeded, or (3) the analysis becoming invalid.

Based on its audit, and review of the applicant’s responses to RAIs B.2.16-1, B.2.16-2, B.2.16-3, B.2.16-4, B.2.16-5, and B.2.16-7, the staff finds that elements one through six of the applicant’s Fatigue Monitoring Program, as enhanced, are consistent with the corresponding program elements of GALL Report AMP X.M1 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.16 summarizes operating experience related to the Fatigue Monitoring Program. The applicant stated that it reviewed the broader industry experience on fatigue issues and factored these into the Fatigue Monitoring Program. The applicant also stated that the review included NRC documents (information notices (IN), bulletins, regulatory issue summaries (RIS), and RGs), vendor notices, industry documents (NEI, INPO, and EPRI), and other utility LRAs. The applicant further indicated that LRA Section B.2.16 provides specific examples of that experience showing how its program has remained responsive to emerging issues and concerns.

The applicant's review noted that its program did not require changes to address concerns discussed in a recent NRC document RIS 2008-30, which dealt with the use of single dimension stress factors in on-line fatigue analyses. The applicant stated that the changes were not required because its program does not perform on-line fatigue analyses, and its fatigue analyses of record evaluate multi-dimensional stresses appropriate to each component. The applicant indicated that its program updated its fatigue analyses of record and the fatigue transients (cycles) being counted in response to the NRC and vendor information concerning the assessment of thermal stratification in its pressurizer surge line.

The applicant also stated that, as part of the program review phase of its restart effort (during the 13th RFO ended March 27, 2004), it discovered that the program implementation (namely, AOTC Program) had not been updated or reviewed for approximately 4 years. In response, the applicant noted that its Corrective Action Program processed the issue as a significant condition adverse to quality and performed a root cause analysis identifying deficiencies in the Fatigue Monitoring Program. The applicant stated that several program changes were made including the addition of a requirement to perform periodic self-assessments. The staff noted that the operating experience indicates that the program has been improved based on plant-specific review or self-assessment through the Corrective Action Program.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant-specific operating experience information to determine if the applicant adequately incorporated and evaluated the operating experience related to this program. More specifically, during its audit, the staff's review of applicant's operating experience and condition reports indicated that inservice fatigue issues had occurred, such as thermal sleeve cracking and welded plug cracking; however, LRA Section B.2.16 did not discuss these fatigue issues, the corrective actions taken, and how the existing program was modified based on the operating experience.

By letter dated April 20, 2011, the staff issued RAI B.2.16-6 requesting that the applicant:

- justify the effectiveness of the existing program with examples and sufficient details from its plant-specific experience to demonstrate that timely identification of observed fatigue degradation was achieved
- provide the corrective actions taken to prevent the recurrence of such inservice failures
- discuss any improvements that were incorporated into the program based on its own plant-specific fatigue experience

In its response dated June 3, 2011, the applicant revised the "operating experience" program element of its Fatigue Monitoring Program to include additional plant-specific operating experience. In particular, the applicant discussed its operating experience associated with the HPI nozzles in which implementation of the HPI system pressure isolation integrity test of back-to-back check valves was required to be counted as a cycle against HPI nozzles used in makeup service. The applicant also discussed the operating experience related to pressurizer surge line (NRC Bulletin 88-11) in which the heatup and cooldown transients need be redefined. The staff noted that this operating experience indicates that the program was effective in identifying new transients and incorporating them in the Fatigue Monitoring Program.

Based on its review, the staff finds the applicant's response to RAI B.2.16-6 acceptable because (1) it was demonstrated that the program was effective in identifying new transients and incorporating them in its Fatigue Monitoring Program, and (2) the applicant demonstrated that its program has been improved based on plant-specific review or self-assessment through its Corrective Action Program. The staff's concern described in RAI B.2.16-6 is resolved.

Based on its audit and review of the application and RAI B.2.16-6, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.16, as amended by letter dated June 3, 2011, provides the USAR supplement for the Fatigue Monitoring Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 4.3-2.

The staff noted that the applicant revised its Commitment No. 9 in response to RAIs B.2.16-3, B.2.16-4, and B.2.16-5 to enhance its Fatigue Monitoring Program prior to entering the period of extended operation. Specifically, the applicant committed to the following:

- The applicant will provide for updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached. When the number of accrued cycles is within 75 percent of the allowable cycle limit for any transient, a condition report will be generated. For any transient whose cycles are projected to exceed the allowable cycle limit by the end of the next plant operating cycle (Davis-Besse operating cycles are normally 2 years in duration), the program will require an update of the fatigue usage calculation for the affected component(s).
- The applicant will establish an acceptance criterion for maintaining the cumulative fatigue usage below the Code design limit of 1.0 through the period of extended operation, including environmental effects where applicable.

The staff also noted that the applicant added Commitment No. 42 in response to RAI B.2.16-2, to enhance its Fatigue Monitoring Program 1 year prior to entering the period of extended operation. In this commitment, specifically, the applicant committed to do the following:

> Evaluate additional plant-specific component locations in the reactor coolant pressure boundary that may be more limiting than those considered in NUREG/CR-6260. This evaluation will include identification of the most limiting fatigue locations exposed to reactor coolant for each material type (i.e., CS, LAS, SS, and NBA) and that each bounding material/location will be evaluated for the effects of the reactor coolant environment on fatigue usage. Nickel based alloy items will be evaluated using NUREG/CR-6909. This evaluation will be submitted to the NRC one year prior to the period of extended operation.

The staff also determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Fatigue Monitoring Program, the staff determined 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 implementation through Commitment Nos. 9 and 42, as amended by letter dated June 3, 2011, prior to the period of extended operation would make the existing program consistent with GALL Report AMP X.M1 to which it was compared. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B.2.17 describes the existing Fire Protection Program as consistent with exceptions with GALL Report AMP XI.M26, "Fire Protection." The applicant stated that the Fire Protection Program manages aging effects for components that have a fire barrier function, including fire damper framing, fire-related penetration seals, fire wraps, fire proofing, fire doors, and fire barrier walls, ceilings, and floors. The applicant also stated that the Fire Protection Program is a condition and performance monitoring program consisting of tests and inspections performed in accordance with the applicable NFPA recommendations. The applicant further stated that the Fire Protection Program also supplements the Fuel Oil Chemistry Program to monitor performance of the diesel fire pump.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M26. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.M26.

The staff also reviewed portions of the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the exceptions to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluations of these exceptions follows.

Exception 1. LRA Section B.2.17 states an exception to the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. The applicant stated that it has no fixed halon or carbon dioxide suppression systems installed within the protected area; therefore, the associated portions of GALL Report AMP XI.M26 are not applicable to its Fire Protection Program.

The staff reviewed the applicant's program basis document and noted that the applicant does not have any permanent halon or carbon dioxide suppression systems that are within the scope of license renewal. The staff finds the exception acceptable because there are no permanent halon or carbon dioxide suppression systems to inspect; therefore, the associated portions of GALL Report AMP XI.M26 are not applicable.

Exception 2. LRA Section B.2.17 states an exception to the “acceptance criteria” program element. The applicant stated that its Fire Protection Program does not include specific confirmation of “no corrosion in the fuel oil supply line for the diesel fire pump.” The applicant also stated that periodic performance testing of the diesel fire pump will be performed through the Fire Protection Program and that degradation in the fuel oil supply line would be noted during this testing. The applicant further stated that the One-Time Inspection Program will be used to characterize the internal surface condition of the fuel oil supply line to confirm the effectiveness of the Fuel Oil Chemistry Program.

The staff reviewed the applicant’s program basis document and noted that the applicant will perform periodic flow and discharge tests, sequential starting capability tests, and controller function tests of the diesel driven fire pump. The staff also noted that the applicant will monitor the internal surface condition of the fuel oil supply using the One-Time Inspection Program. The staff finds the exception acceptable because periodic testing of the diesel fire pump and use of the One-Time Inspection Program to characterize the surface condition of the fuel oil supply is adequate to detect aging in the fuel oil supply line.

Based on its audit, the staff finds that elements one through six of the applicant’s Fire Protection Program, with acceptable exceptions, are consistent with the corresponding program elements of GALL Report AMP XI.M26 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.17 summarizes the applicant’s operating experience review associated with the Fire Protection Program. The applicant stated that a review of past fire barrier, fire penetration seal, fire wrap, fire door, and diesel fire pump inspections confirmed the acceptability of the inspection frequency and ability of the inspections to identify degradation prior to loss of intended function. The applicant also stated that the two most recent triennial fire protection inspections performed by the staff did not identify any findings of significance. The applicant further stated that a review of recent audits, health reports, and self-assessments revealed no NRC or management concerns regarding the fire protection system.

During the audit, the staff reviewed the applicant’s program basis documents. The applicant’s program basis documents summarized operating experiences related to the Fire Protection Program. The applicant stated that cracks in newly installed fireproofing were identified in September 8, 2009, during a walkdown. The applicant also stated that the cracks were several inches long but had negligible width and depth; therefore, there was no concern that the fireproofing would not be able to perform its intended function. The applicant further stated that the loose material was removed, and a touch up of the coating was performed. The applicant also cited an operating experience example, documented on March 24, 2009, where a missing screw was found on a fire door. The door was declared inoperable, and an hourly roving fire watch was established. The applicant initiated repairs to replace the screw.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant’s program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that the operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.17 provides the USAR supplement for the Fire Protection Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.3-2. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fire Protection Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for the AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Fire Water Program

Summary of Technical Information in the Application. LRA Section B.2.18 describes the existing Fire Water Program as consistent, with enhancements, with GALL Report AMP XI.M27, "Fire Water System." The applicant stated that the Fire Water Program is an existing condition monitoring program that applies to the fire water supply and water-based suppression systems and includes tests and inspections performed in accordance with applicable NFPA recommendations. The applicant also stated that this program manages fire water supply and water-based fire suppression components for loss of material, as well as cracking of susceptible materials. The applicant further stated that the program includes periodic inspection and testing activities including hose station inspections, fire main flushes, flow tests, tank inspections, and sprinkler system inspections.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M27. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M27, with the exception of the "scope of program" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

GALL Report AMP XI.M27 states that the Fire Water System Program manages loss of material due to corrosion, MIC, or biofouling and includes flow testing, visual inspections, and non-intrusive examinations to detect these aging effects. The staff noted that the applicant's Fire Water Program will manage loss of material as well as cracking of susceptible materials.

The applicant's program basis document states that cracking due to SCC of copper alloy with greater than 15 percent Zn components will be managed using the same testing and inspection activities that are used to identify and manage loss of material. The staff also noted that flow tests and visual inspections are not industry accepted methods for detecting cracking. It is unclear to the staff what technique the applicant plans to use in its Fire Water System Program that will adequately manage cracking of susceptible copper-alloy components with greater than 15 percent Zn. By letter dated April 20, 2011, the staff issued RAI B.2.18-1 requesting that the applicant provide additional information regarding what technique will be used to detect cracking of the susceptible copper-alloy fire water system components.

In its response dated May 24, 2011, the applicant stated that SCC is an applicable aging effect for copper-alloy components containing greater than 15 percent Zn, which are exposed to raw water environments containing ammonia or ammonium salts. The applicant also stated that it could not verify the absence of ammonia in its raw water source to be below a threshold concentration in which cracking would not be a concern; but, its review of industry and plant-specific operating experience concluded that cracking of copper-alloy components due to SCC is not expected to occur in its raw water environment. The applicant further stated that it plans to use the One-Time Inspection Program to ensure that this aging effect is not occurring because, although the aging effect is not expected to occur, it has insufficient data to rule it out. The applicant revised its Fire Water System Program to remove cracking as an aging effect the program manages. The applicant also revised its One-Time Inspection Program to perform enhanced visual or volumetric examinations for cracking of copper alloy with greater than 15 percent Zn components exposed to raw water. The staff finds the applicant's response unacceptable because the GALL Report states that cracking could occur in copper-alloy components exposed to raw water; therefore, a one-time inspection is not appropriate to manage aging for these components. The staff discussed the RAI response with the applicant by conference call held June 30, 2011, and the applicant agreed to revise its response to RAI B.2.18-1.

By letter dated July 22, 2011, the applicant revised its response to RAI B.2.18-1 to remove cracking as an aging effect that is managed by the Fire Protection System Program. The applicant stated that there are no management activities in the Fire Protection System Program that will be used to manage cracking of copper-alloy (with greater than 15 percent Zn) components that are exposed to raw water. The applicant also stated that SCC or IGA in the identified copper alloys in a raw water environment is only a potential aging effect when ammonia or ammonium salt in raw water is present. The applicant further stated that a review of operating experience did not identify ammonia or an ammonium salt in the raw water or cracking of copper alloys in the associated system. The staff finds the applicant's response acceptable because the raw water source does not contain ammonia or ammonium salt, which is the component in raw water that would otherwise lead to SCC. The staff's concern described in RAI B.2.18-1 is resolved.

The staff also reviewed the portions of the "parameters monitored or inspected" and "detection of aging effects" program elements associated with the enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.18 states an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements to add a program requirement to perform periodic ultrasonic testing for wall thickness of representative above-ground water suppression piping that is not periodically flow tested but contains, or has contained, stagnant water. The applicant stated that ultrasonic testing will be performed prior to the period of extended operation and at appropriate intervals thereafter, based on engineering evaluation of the initial results.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27. GALL Report AMP XI.M27 states that wall thickness evaluations of fire protection piping are performed on system components using non-intrusive techniques such as volumetric testing. GALL Report AMP XI.M27 also states that these inspections are performed before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation. The staff finds the applicant's enhancement acceptable because it will add ultrasonic testing for wall thickness, conducted prior to the period of extended operation and at plant-specific intervals, which is consistent with the recommendations in GALL Report AMP XI.M27.

Enhancement 2. LRA Section B.2.18 states an enhancement to the "detection of aging effects" program element to add a program requirement to perform at least one opportunistic or focused visual inspection of the internal surface of buried fire water piping and of similar above-ground fire water piping within the 5-year period prior to the period of extended operation. The applicant also stated that this inspection will be used to confirm that the conditions on the internal surface of above-ground fire water piping can be extrapolated to be indicative of the conditions on the internal surface of buried fire water piping.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M27. GALL Report AMP XI.M27 states that if the environmental and material conditions that exist on the interior surface of below-grade fire protection piping are similar to the conditions that exist in above-grade piping, the results of the inspection on the above-grade piping can be extrapolated to the below-grade fire protection piping. The staff finds the applicant's enhancement acceptable because the applicant will conduct inspections that ensure the conditions in the internal surface of the below-grade fire protection piping are similar to that of the above-grade piping, which is consistent with the recommendations in GALL Report AMP XI.M27

Enhancement 3. LRA Section B.2.18 states an enhancement to the "detection of aging effects" program element to add a program requirement to perform representative sprinkler head sampling or replacement prior to 50 years inservice and at 10-year intervals thereafter, in accordance with NFPA-25, or until there are no untested sprinkler heads that will see 50 years of service through the end of the period of extended operation.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M27. GALL Report AMP XI.M27 states that sprinkler heads are tested before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the period of extended operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner. The staff finds the applicant's enhancement acceptable because the applicant will inspect the sprinkler heads or replace them prior to 50-years of service, which is consistent with the recommendations in GALL Report AMP XI.M27.

Enhancement 4. LRA Section B.2.18 states an enhancement to the "detection of aging effects" program element to add a program requirement to perform opportunistic fire water supply and water based suppression system internal inspections each time one of these systems is opened for repair or maintenance. The LRA states that these inspections will be considered acceptable if representative water supply and water-based suppression system locations are inspected, inspections are performed on a reasonable basis, and the inspections are capable of evaluating wall thickness and flow capability. The LRA also states that if these inspections are not completed on a representative number of samples, then ultrasonic testing will be used to complete the representative sample.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M27. GALL Report AMP XI.M27 states that the plant maintenance process may include a visual inspection of the internal surface of the fire protection piping upon each entry to the system for routine or corrective maintenance, as long as it can be demonstrated that inspections are performed (based on past maintenance history) on a representative number of locations on a reasonable basis. GALL Report AMP XI.M27 also states that these inspections should be capable of evaluating wall thickness to ensure against catastrophic failure and the inner diameter of the piping as it applies to the design flow of the fire protection system. The staff finds the applicant's enhancement acceptable because the applicant will conduct opportunistic inspections that are capable of evaluating wall thickness and flow capability, which is consistent with the recommendations in GALL Report AMP XI.M27

Based on its audit, and review of the applicant's response to RAI B.2.18-1, the staff finds that elements one through six of the applicant's Fire Water Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL Report AMP XI.M27 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.18 summarizes operating experience related to the Fire Water Program. The applicant stated that the NRC conducts triennial fire protection inspections, and the most recent inspection performed in 2007 identified no findings of significance. The applicant also stated that, during the triennial inspection performed in 2004, the NRC identified a violation related to licensing and the bases for an exemption being changed via modification, but it was not related to the Fire Water Program. The applicant further stated an operating experience example in which it identified minor corrosion of the fire water storage tank after it was replaced. The applicant evaluated the extent of corrosion and determined that it was not significant.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.18 provides the USAR supplement for the Fire Water Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.3-2. The staff also noted that the applicant committed (Commitment No. 10) to enhance the existing Fire Water Program prior to entering the period of extended operation. Specifically, the applicant committed to do the following:

- perform periodic ultrasonic testing for wall thickness
- perform at least one opportunistic or focused visual inspection of the internal surface of buried fire water piping
- perform representative sprinkler head sampling or replacement prior to 50 years in service
- perform opportunistic fire water supply and water-based suppression system internal inspections each time the systems are breached for repair or maintenance

The staff determines that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fire Water Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation, through Commitment No. 10, 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.20 describes the existing Fuel Oil Chemistry Program as consistent, with exceptions, with GALL Report AMP XI.M30, "Fuel Oil Chemistry." The applicant stated that the program verifies and maintains the quality of the fuel oil consumed in the EDGs, diesel fire pump, and SBODG to mitigate the effects of aging for the storage tanks and associated piping and components containing fuel oil that are within the scope of license renewal. The applicant also stated that the program manages the presence of contaminants, such as water or microbiological organisms, which could lead to the onset and propagation of loss of material or cracking through proper monitoring and control of fuel oil consistent with plant TS and ASTM Standards for fuel oil. The applicant indicated that the following actions are performed to minimize contaminants:

- verification of the quality of new fuel oil before it enters the storage tanks
- periodic sampling of tank contents to ensure the fuel oil is free of water and particulates
- periodic cleaning and inspection of tanks containing fuel oil

Staff Evaluation. During the audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M30. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M30, with exception of the "detection of aging effects" program element.

For this, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

By letter dated April 5, 2011, the staff issued RAIs B.2.20-1 and B.2.20-2. RAI B.2.20-1 requested that the applicant discuss how the 12-year interval for draining and cleaning of tanks DB-T47 and DB-T210 is consistent with GALL Report AMP XI.M30. In RAI B.2.20-2, the staff asked the applicant to discuss if volumetric inspections of tank internal surfaces will be performed, as recommended by GALL Report AMP XI.M30.

In the applicant's response dated May 5, 2011, the applicant amended the Fuel Oil Chemistry Program to include a 10-year frequency of draining and cleaning instead of the previously held 12-year interval. In addition, the applicant modified the AMP such that visual inspections will be performed on tank internal surfaces to detect potential degradation. The applicant also stated that if degradation is identified in a diesel fuel tank by visual inspections, a volumetric inspection will be performed.

The staff finds the applicant's response acceptable because periodic draining and cleaning of diesel fuel tanks is performed so that internal surfaces can be visually and volumetrically inspected as applicable. In addition, performance of volumetric inspections on degradation identified by visual inspections of the diesel fuel tank internal surfaces is an acceptable means to verify the presence of corrosion or other degradation inside the tanks. The staff's concerns described in RAIs B.2.20-1 and B.2.20-2 are resolved.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects" and "acceptance criteria" program elements associated with exceptions to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions follows.

Exception 1. LRA Section B.2.20 states an exception to the "scope of program" and "acceptance criteria" program elements. The GALL Report AMP, Element 1, recommends managing the conditions that cause corrosion of the diesel fuel tank internal surfaces in accordance with TS and guidelines of ASTM Standards D1796, D2276, D2709, D6217 and D4057. In addition, the GALL Report AMP, Element 6, recommends using ASTM D6217 or Modified D2276, Method A as guidance for determination of particulates. The modification to D2276 consists of using a filter with a pore size of 3.0 µm, instead of 0.8 µm. This program element in the LRA states that the program does not explicitly use ASTM D6217. The applicant stated that Davis-Besse uses ASTM D2276 instead of ASTM D6217 for guidance on the determination of particulate contamination. The applicant further stated that ASTM D2276 is used, with an acceptance criterion of a total particulate contamination of less than 10 milligrams per liter (mg/l).

The staff reviewed this exception to the GALL Report and noted that the applicant took exception to these elements because Davis-Besse uses ASTM Standard D2276 instead of D6217 for guidance on the determination of particulate contamination. The staff finds this exception acceptable and these program elements consistent to the one described in the GALL Report because both standards are acceptable for determination of particulates, as recommended by the GALL Report.

Exception 2. LRA Section B.2.20 states an exception to the "scope of program," "parameters monitored or inspected," and "acceptance criteria" program elements. The GALL Report AMP, Element 1, recommends managing the conditions that cause corrosion of the diesel fuel tank internal surfaces in accordance with TS and the guidelines of ASTM Standards D1796, D2276, D2709, D6217, and D4057. In addition, the GALL Report AMP, Elements 3 and 6, recommend using ASTM D1796 and D2709 for determination of water and sediment contamination in diesel fuel. This program does not explicitly use ASTM D1796 but uses ASTM D4176 or D2709 instead. The applicant stated that ASTM D1796 provides guidance for water and sediment determination in No. 4D diesel fuel, which is not used at Davis-Besse. It was further stated that ASTM D4176 is used for guidance on the determination of fuel oil appearance and ASTM D2709 is used for guidance on determination of water and sediment contamination. Furthermore, the applicant stated that ASTM D4176 or ASTM D2709 is used with the acceptance criteria of clear and bright with appropriate color or water and sediment contamination less than 0.05 percent by volume, respectively.

The staff reviewed this exception to the GALL Report and noted that the applicant took exception because this program does not explicitly use ASTM D1796 but uses ASTM D4176 or D2709 instead. The staff finds this exception acceptable because the detection limit of ASTM D4176 for free water and sediment contamination, with an experienced operator, is approximately 40 parts per million (ppm) and is not dependent on ambient temperature above the cloud point of the fuel. The detection limit for ASTM D2709 is 50 ppm at 21–32 degrees Celsius. The staff finds the use of ASTM D4176 an acceptable substitute to ASTM D1796 because it allows for the applicant to have an immediate indication of any contamination in a fuel delivery prior to allowing the fuel to reach the fuel storage tanks. The use of ASTM D4176 along with ASTM D2709 allows two separate checks of the fuel oil using two different analyses with similar detection limits. Furthermore, the staff notes that ASTM D1796 provides guidance for water and sediment determination for No. 4D diesel fuel. Davis-Besse does not use No. 4D diesel fuel; instead, it uses No. 2D diesel fuel. ASTM D4176 and ASTM D2709 provide guidance on water and sediment determination for No. 2D diesel fuel. The staff finds the use of these two standards consistent with GALL Report AMP XI.M30.

Exception 3. LRA Section B.2.20 states an exception to the “parameters monitored or inspected” program element. The GALL Report, Element 3, recommends the use of modified ASTM D2276, Method A, for the determination of particulates. The modification consists of using a filter with a pore size of 3.0 µm instead of 0.8 µm. The applicant’s program does not use a filter pore size of 3.0 µm; instead, a filter with 0.8 µm pore size is used. The applicant further stated that the 0.8 µm filter is more conservative than the 3.0 µm filter because smaller particles are retained resulting in a larger sample of particulates.

The staff reviewed this exception to the GALL Report and noted that the applicant took exception because this program does not use the filter pore size of 3.0 µm; instead, it uses a filter pore size of 0.8 µm. The staff finds this exception acceptable because the use of a 0.8 µm filter is more conservative than use of a 3.0 µm filter, which is recommended in GALL Report AMP XI.M30.

Exception 4. LRA Section B.2.20 states an exception to the “detection of aging effects” program element. The GALL Report, Element 4, recommends periodic multilevel sampling of the fuel oil to ensure that fuel oil contaminants are below unacceptable levels. The applicant stated that instead, this program does not perform multilevel sampling of the fuel oil storage tanks. The applicant also stated that composite samples are taken from three separate locations in the lower portion of the EDG fuel oil storage tanks, where contaminants may collect.

The staff reviewed this exception to the GALL Report and noted that the applicant took exception to the GALL Report in that multilevel sampling is not performed to obtain samples from the EDG fuel oil storage tanks. The staff finds this exception acceptable because the applicant stated that the current method of sampling takes a composite sample from three separate locations at the bottom of the EDG fuel oil storage tanks, where contaminants may collect. The staff determined that this sampling method allows for more conservative test results since the contaminants tend to settle at the bottom of the tank. The staff finds this program exception acceptable because the sampling used in the AMP is equivalent or more conservative than the ASTM Standards recommended by GALL Report AMP XI.M30.

Exception 5. LRA Section B.2.20 states an exception to the "preventive actions" program element. The GALL Report, Element 2, recommends the use of biocides, stabilizers, and corrosion inhibiters. The applicant stated that this program does not include the routine addition of biocides, stabilizers, or corrosion inhibitors to the fuel oil. The applicant stated that the combination of ensuring specified physical and chemical properties of new fuel oil are within limits, and periodic cleaning and draining of the tanks has been shown to mitigate corrosion inside the tanks and fuel oil degradation. The applicant also stated that, if necessary, fuel oil additives may be used at the program owner's discretion.

The staff reviewed this exception noting that the applicant provided justification for not using biocides, stabilizers, and corrosion inhibitors by stating that periodic cleaning and draining of the tanks provides assurance that corrosion inside tanks is minimized. Although this is the case, the applicant stated that fuel oil additives may be used at the program owner's discretion. This is acceptable per GALL Report, AMP XI.M30.

Based on its audit, the staff finds that Elements one through six of the applicant's Fuel Oil Chemistry Program, with acceptable exceptions, are consistent with the corresponding program elements of GALL Report AMP XI.M30 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.20 summarizes operating experience related to the Fuel Oil Chemistry Program. The applicant stated that the program is an ongoing program that uses sampling and analysis to ensure that adequate diesel fuel quality is maintained to minimize degradation. The applicant reported that no instances of fuel oil system component failure due to instances of contamination have been identified at Davis-Besse.

The applicant provided the following information regarding operating experience:

The applicant stated that water has occasionally been discovered in various diesel fuel oil storage tanks during sampling activities. The applicant also stated that any detected water is removed from the affected tank as part of the sampling process. The applicant further stated that it reported that abnormal fuel oil chemistry conditions, such as high particulate levels and suspended solids, are identified, evaluated, and corresponding adjustments made through the Corrective Action Program to correct the chemistry conditions well before a loss of function. The applicant provided the following examples.

- The monthly particulate and non-particulate tests following cleaning of the fuel oil day tank for the SBODG in 2007 were within specification; however, an increase in the time to perform the particulate test for the tank was noted.
- Higher than normal particulate levels were noted during sampling of one of the EDG fuel oil day tanks in 2006. The tank was re-sampled with the results being more consistent with past values (and within specification). To minimize sludge/particulate transport to the diesel day tanks during preventive maintenance evolutions, corrective actions were implemented to blow excess fuel lines into the day tank using air, perform a longer purge

of transport lines to remove old fuel that was in the transfer pipe, and a cautionary note added to sampling procedures.

- High particulate levels were identified in 2003 and determined to be the result of using high sulfur diesel fuel and not adding stabilizer to the fuel. After additional evaluation, it was determined that the use of low sulfur diesel would ensure the operational control limits will be more consistently met.

The applicant stated that cleaning and visual inspection of fuel oil tanks is conducted regularly. The applicant also stated these inspections have revealed acceptable conditions for the tank internal surfaces (i.e., no significant material loss to the condition of the tank). The applicant stated that during the scheduled 2003 cleaning of the diesel generator fuel oil storage tanks, it identified corrosion at the top of the tanks. The applicant also stated that this tank corrosion led to partial clogging of fuel filters and was evaluated for continued use, but did not reveal a loss of component function of subject components. The applicant further stated that the SBODG fuel oil day tank was cleaned and inspected in 2006 with no issues.

In addition, the applicant performed a fleet oversight QA audit to assess the operation practices and regulatory compliance of the laboratory where fuel oil samples from Davis-Besse are sent for oil analysis. As a result of this audit, multiple areas of improvement were identified, and Corrective Action Program items were generated to document and track the recommended improvements.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation. Although the applicant identified instances of abnormal fuel oil chemistry and degradation (i.e., corrosion), the operating experience has shown that appropriate corrective actions were taken such that adjustments were made to correct the chemistry conditions. Furthermore, the applicant has increased the frequency of tank inspections and cleaning, such that it is performed at a 10-year frequency. The increased inspection and cleaning frequency will allow detection of degradation in tank internal surfaces, which will minimize contaminants in the fuel oil. The periodic sampling and testing of diesel fuel oil and inspection and cleaning of fuel oil tanks ensure that the program will continue to identify and evaluate fuel oil chemistry and detect potential aging effects.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.20 provides the USAR supplement for the Fuel Oil Chemistry Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in

SRP-LR Table 3.3-2. The USAR supplement description contained in the SRP-LR provides an acceptable program description relative to GALL Report AMP XI.M30, “Fuel Oil Chemistry,” which includes the specific ASTM Standards to be used for monitoring and control of fuel oil contamination to maintain fuel oil quality. The staff reviewed the USAR supplement and noted that it did not specify the ASTM Standards to be used for the program. As such, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

By letter dated April 5, 2011, the staff issued RAI B.2.20-3. The staff requested that the applicant justify the absence of ASTM Standards D975, D2276, D2709, D4057, and D4176 from the USAR supplement. These ASTM Standards are found in the Davis-Besse Fuel Oil Chemistry Program. In the applicant’s response, dated May 5, 2011, the applicant provided an amended USAR supplement that includes the ASTM Standards mentioned above. The staff finds the applicant’s response acceptable because specifying the ASTM Standards used for the program ensures that there is an adequate description of the standards used for the program in the USAR supplement, thereby providing assurance that it will be properly executed during the period of extended operation. The staff's concern described in RAI B.2.20-3 is resolved.

The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant’s Fuel Oil Chemistry Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR 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 Masonry Wall Inspection

Summary of Technical Information in the Application. LRA Section B.2.27 describes the existing Masonry Wall Inspection Program as consistent, with enhancements, with GALL Report AMP XI.S5, “Masonry Wall Program.” The applicant stated that the program is implemented as part of the Structures Monitoring Program and consists of inspection activities to detect age-related degradation for masonry walls within the scope of license renewal. The applicant also stated that masonry walls that perform a fire barrier intended function are also managed by the Fire Protection Program.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL Report AMP XI.S5. As discussed in the audit report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL Report AMP XI.S5, with the exception of the “detection of aging effects,” and “acceptance criteria” program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

While reviewing the “detection of aging effects” program element, the staff noted that the Structures Monitoring and Masonry Wall Programs periodically monitor the structures through visual inspections to identify degradation that could impair the functional performance of the structure. The standard interval between periodic assessments for a particular structure is 4 years, but the frequency can vary between 2–10 years depending on the location and environment, susceptibility to degradation, and the age of the structure. It was unclear to the staff if the inspection frequency met the recommendations of the GALL Report that structures within the scope of license renewal be monitored on a frequency not to exceed 5 years. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.39-5 asking the applicant to identify the structures and masonry walls that will be inspected on a frequency greater than 5 years, along with their environments and a summary of past degradation. The staff also requested a technical justification for any inspection interval greater than 5 years.

In its response dated May 24, 2011, the applicant revised the LRA Section B.2.27 and added Commitment No. 12 to specify that masonry walls be inspected at least once every 5 years, with provisions for more frequent inspections if necessary. The staff finds this response acceptable because it aligns the applicant’s program with the recommendations in the GALL Report for an appropriate inspection interval. The staff’s concern described in RAI B.2.39-5 is resolved.

The staff also reviewed the portions of the “scope of program,” “monitoring and trending,” and “acceptance criteria” program elements associated with enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.27 states an enhancement to the “scope of program” program element. This enhancement expands on the existing program element by adding a list of structures within the scope of license renewal that credit the Masonry Wall Inspection Program for aging management.

The staff finds this enhancement acceptable because, when implemented, the Masonry Wall Inspection Program will address the masonry walls included within the scope of license renewal. This enhancement brings the “scope of program” program element of the Masonry Wall Inspection Program into compliance with the “scope of program” program element recommendations provided in GALL Report AMP XI.S5, “Masonry Wall Program.”

Enhancement 2. LRA Section B.2.27 states an enhancement to the “monitoring and trending” program element. This enhancement expands on the existing program element by adding the documentation requirements of 10 CFR 54.37, including the submittal of records of structural evaluations to records management.

The staff finds this enhancement acceptable because, once implemented, the Masonry Wall Inspection Program will meet the requirements of 10 CFR 54.37 for program documentation and record-keeping related to license renewal.

Enhancement 3. LRA Section B.2.27 states an enhancement to the “acceptance criteria” program element. This enhancement expands on the existing program element by adding guidance that observed degradation must be evaluated to ensure that the current evaluation basis is still valid. The LRA also states that corrective action is required if the degradation is sufficient to invalidate the evaluation basis.

While reviewing the “acceptance criteria” program element, and the associated enhancement, the staff noted that the program basis documents state that acceptance criteria are established such that corrective actions are initiated prior to a loss of function. GALL Report AMP XI.S5 states that corrective actions should be taken if the extent of cracking and steel degradation is sufficient to invalidate the evaluation basis. It is not clear to the staff that these statements are consistent because the Masonry Wall Inspection Program and its enhancement do not provide any guidance related to what type or extent of degradation would lead to corrective actions or a re-evaluation. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.27-1, asking the applicant to describe the acceptance criteria used to trigger corrective actions as well as a technical justification for the acceptance criteria.

In its response dated May 24, 2011, the applicant stated that masonry walls are inspected for cracking, and walls with cracks greater than one-sixteenth of an inch or through-wall cracks require further investigation. The applicant also stated that the program will be enhanced to specify that the extent of observed masonry cracking or degradation is evaluated to ensure the current evaluation basis remains valid. The staff finds this response acceptable because the applicant has committed (Commitment No. 12) to enhance the program to require evaluation of any observed cracking or degradation of steel supports or bracing. This evaluation will ensure that corrective actions are taken if the degradation is sufficient to invalidate the current evaluation basis. The staff's concern described in RAI B.2.27-1 is resolved.

Based on the staff's review, and the applicant's response to RAI B.2.27-1, the staff finds the applicant's enhancement to the "acceptance criteria" program element acceptable.

Based on its audit, and review of the applicant's responses to RAIs B.2.39-5 and B.2.27-1, the staff finds that elements one through six of the applicant's Masonry Wall Inspection Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL Report AMP XI.S5 and, therefore, are acceptable.

<u>Operating Experience</u>. LRA Section B.2.27 summarizes operating experience related to the Masonry Wall Inspection Program. The applicant stated that past inspections have found minor degradation including cracks, abandoned bolts, and unfilled drilled holes. The applicant also stated that inspections noted several walls in the auxiliary building that have minor cracks less than one-sixteenth of an inch. The applicant further stated that these areas have been reviewed and judged acceptable.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.27 provides the USAR supplement for the Masonry Wall Inspection Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.5-2.

The staff also noted that the applicant committed (Commitment No. 12) to enhance the Masonry Wall Inspection Program prior to entering the period of extended operation. Specifically, the applicant committed to the following:

- The applicant will include and list the structures within the scope of license renewal that credit the program for aging management.
- The applicant will add an action to follow the documentation requirement of 10 CFR 54.37, including submittal of records of structural evaluation to records management.
- The applicant will specify that, for each masonry wall, the extent of observed masonry cracking or degradation of steel edge supports or bracing is evaluated to ensure that the current evaluation basis is still valid. Corrective action is required if the extent of masonry cracking or steel degradation is sufficient to invalidate the evaluation basis. An option is to develop a new evaluation basis that accounts for the degraded condition of the wall (i.e., acceptance by further evaluation).
- The applicant will specify that inspection will be conducted at least once every 5 years, with provisions for more frequent inspections in areas where significant loss of material or cracking is observed.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Masonry Wall Inspection Program, the staff determined 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, would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 One-Time Inspection

Summary of Technical Information in the Application. LRA Section B.2.30 describes the new One-Time Inspection Program as consistent, with enhancements, with GALL Report AMP XI.M32, "One-Time Inspection." The applicant stated that the program addresses component, material, and environment combinations where an aging effect is not expected to occur, but there is insufficient data to completely rule it out or an aging effect is expected to progress very slowly in the specified environment, and the local environment may be more adverse. The applicant also stated that the program will verify the effectiveness of the Fuel Oil Chemistry Program, the Lubricating Oil Analysis Program, and the PWR Water Chemistry Program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M32. As discussed in the audit report, the staff confirmed that these elements are consistent with the corresponding elements of GALL Report AMP XI.M32, with the exception of the "detection of aging effects" program element. In this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

The "detection of aging effects" program element of GALL Report AMP XI.M32 states that the program should include the following:

- determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience
- identification of the inspection locations based on the potential for the aging effect to occur
- determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined

GALL Report AMP XI.M32 also states that, where practical, the inspection includes a representative sample of the system population and focuses on the bounding or lead components most susceptible to aging, where a representative sample size is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) or a maximum of 25 components. The LRA states that the sample population will be determined by engineering evaluation and, where practical, will be focused on the components considered most susceptible to aging degradation due to time in service, the severity of the operating conditions, and the lowest design margin.

However, the staff noted that the applicant's program did not contain details describing the size of the sample population, consistent with the GALL Report recommendations. By letter dated June 20, 2011, the staff issued RAI B.2.30-1 requesting that the applicant provide a technical justification for the current methodology and sample size used to select components for inspection within the One-Time Inspection Program, in lieu of methodology consistent with the GALL Report.

In its response dated July 22, 2011, the applicant revised the program to include a sample size of 20 percent of the population (defined as components having the same material, environment, and aging effect combination) or a maximum of 25 components. The applicant stated that the sample population will be determined by engineering evaluation and, where practical, will be focused on the (bounding or lead) components considered most susceptible to aging degradation due to time in service, the severity of the operating conditions, and the lowest design margin. Additionally, the inspections must occur within the 10-year period prior to the period of extended operation to be credited for the program.

The staff finds the applicant's response acceptable because the program now includes a sampling population and sample selection methodology that is consistent with the GALL Report recommendations and will be effective for evaluating in-scope components in a manner that will identify degradation prior to loss of intended function(s). The staff's concern described in RAI B.2.30-1 is resolved.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements associated with the enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.30 states an enhancement to the "scope of program" element. The applicant stated that the program will be enhanced to include visual inspections of aluminum, copper alloy (including copper alloy greater than 15 percent Zn), stainless steel, and steel (including gray cast iron) components exposed to condensation or diesel exhaust for cracking, loss of material, and reduction of heat transfer.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M32, which states that the program should include components and materials for which the environment during the period of extended operation is expected to be equivalent to that in the prior 40 years and for which no aging effects have been observed. The GALL Report states that the program verifies the effectiveness of an AMP and confirms the insignificance of an aging effect. The GALL Report also states that for this program to be used to confirm the insignificance of an aging effect, confirmation must be demonstrated that either the aging effect is not occurring or that the aging effect is occurring very slowly and does not affect the component's or structure's intended function during the period of extended operation based on prior operating experience data. It is not clear to the staff that the applicant has confirmation that the materials and environments indicated in the enhancement can be categorized as having only insignificant aging effects and thus be justified for management by the One-Time Inspection Program without additional inspections that would be provided by another AMP. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant provide technical justification for using a One-Time Inspection Program to manage the subject materials and aging effects instead of a program that conducts periodic inspections, as recommended by the GALL Report.

In its response dated June 3, 2011, the applicant stated that management of the aging effects such as loss of material, or reduction in heat transfer for the component, material, and environmental combinations discussed in the RAI will be managed by the new plant-specific Internal Surfaces in Miscellaneous Piping and Ducting Program, as discussed in its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff's evaluation of the applicant's response to RAI 3.3.2.71-2 is documented in SER Section 3.3.2.1.9. By letter dated May 24, 2011, the applicant revised this enhancement to only include management of cracking for copper alloy with greater than 15 percent Zn components exposed to raw water in the scope of the program. However, the staff noted that cracking is listed as an aging effect in the GALL Report for copper alloy with greater than 15 percent Zn components and, therefore, a one-time inspection alone is not appropriate to manage the aging effect. In its revised response to RAI B.2.18-1, dated July 22, 2011, this enhancement was deleted because cracking was determined to not be an aging effect for the copper-alloy components exposed to raw water. The staff's evaluation of the applicant's response to RAI B.2.18-1 is documented in SER Section 3.0.3.2.8. The staff finds the applicant's response and its proposal to delete this enhancement acceptable because it will manage these component, material, and environment combinations in accordance with the GALL Report recommendations using other programs or by determining the aging effect is not applicable. The staff's concern described in RAI 3.2.2.1.26-1 is resolved.

Enhancement 2. LRA Section B.2.30 states an enhancement to the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements. The applicant stated that the program will include inspection methods suitable to detect hardening and loss of strength of elastomers (flexible connections). The applicant also stated that the detection of those aging effects will be accomplished by adding physical manipulations, such as prodding, to visual inspections. The staff noted that this enhancement in the applicant's program appropriately identifies aging effects to be managed for elastomers added to the scope of the program. The staff also noted that the use of physical manipulations, as indicated in the description of the enhancement, are industrially accepted methods to adequately detect aging in elastomeric components such as the flexible connections being included in-scope for this AMP.

The "scope of program" program element of GALL Report AMP XI.M32 states that the scope of the program includes components for which no aging effects have been observed or for which the aging effect is occurring very slowly and does not affect the component's or structure's intended function during the period of extended operation, based on prior operating experience data. The staff noted that the GALL Report recommends programs with periodic inspections to manage aging for elastomeric materials. The staff also noted that the applicant credited the One-Time Inspection Program to manage the aging effects instead of using a program with periodic inspections as recommended by the GALL Report. By letter dated April 20, 2011, the staff issued RAI 3.3.2.2.5-1 requesting that the applicant provide justification for the use of this program in lieu of a periodic inspection program.

In its response dated May 24, 2011, the applicant stated that the external surfaces of the in-scope elastomeric materials will be covered by the External Surfaces Monitoring Program. The applicant also stated that the internal surfaces will be covered by the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, which will include physical manipulations as part of the inspection methods. The applicant revised its One-Time Inspection Program to delete this enhancement because elastomers are no longer within the scope of the program.

The staff's evaluation of RAI 3.3.2.2.5-1 is documented in SER Section 3.0.3.2.5. The staff noted that both the External Surfaces Monitoring Program and the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program include visual examinations and physical manipulation of elastomeric components within the scope of the program, which is consistent with the inspection methods recommended by the GALL Report for these components. The staff finds the applicant's response and its proposal to delete this enhancement acceptable because the aging of elastomeric components will be managed by the External Surfaces Monitoring Program and by the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff finds the implementation of these two AMPs consistent with the GALL Report recommendations for the type and frequency of inspections that should be used to detect aging for elastomeric components.

Enhancement 3. LRA Section B.2.30, as amended by letter dated June 3, 2011, states an enhancement to the "scope of program" program element to include visual and volumetric inspections of the stainless steel makeup pump casings for cracking due to cyclic loading.

The staff reviewed this enhancement against GALL Report AMP XI.M32 and noted that the "detection of aging effects" program element states that the program manages cracking due to cyclic loading using enhanced visual (EVT-1 or equivalent), surface, or volumetric examinations. The staff also noted that some types of visual examination may not be sufficient to identify cracking. It was unclear to the staff to what standard the visual examinations will be performed. In a telephone conference dated August 2, 2011, the staff discussed this issue and requested that the applicant clarify what type of visual examinations will be used to identify cracking.

By letter dated August 17, 2011, the applicant revised the LRA to include a table identifying the type of inspections that will be performed to detect the aging effects managed by the program. The table states that enhanced visual (EVT-1 or equivalent), surface (magnetic particle, liquid penetrant), or volumetric (RT or UT) examinations will be used to detect cracking. The staff also noted that in the response dated August 17, 2011, the applicant had incorrectly noted the date of the teleconference as July 27, 2011, instead of August 2, 2011. The staff finds the applicant's response acceptable because these examination techniques are capable of identifying cracking and are consistent with the GALL Report recommendations.

During the license renewal inspection held the week of August 22, 2011, the staff noted that the wording in the enhancement and the commitment (Commitment No. 13) to include inspections of the makeup pump casings for cracking were not consistent with the wording in the "detection of aging effects" program element because they did not state what type of examination would be used to detect cracking. By letter dated August 26, 2011, the applicant revised the wording in the enhancement and Commitment No. 13 to state that the program will include enhanced visual (VT-1 or equivalent) or volumetric (RT or UT) inspections to detect cracking of the stainless steel makeup pump casings. However, the staff noted that the correct abbreviation for enhanced visual examinations is EVT-1, not VT-1 as was stated by the applicant. The staff finds the applicant's response unacceptable because a VT-1 examination is not equivalent to an enhanced visual examination. By letter dated September 16, 2011, the applicant agreed that the designation for enhanced visual examination is EVT-1 and revised Commitment No. 13 and LRA Section B.2.30, One-Time Inspection, to include the correct abbreviation (EVT-1) for enhanced visual examination. The applicant stated that the "One-Time Inspection will also include enhanced visual (EVT-1 or equivalent) or surface examination (magnetic particle, liquid penetrant), or volumetric (RT or UT) inspections to detect and characterize cracking." The staff finds the applicant's response acceptable because EVT-1 enhanced visual examination is an examination technique capable of identifying cracking and is consistent with the GALL Report recommendations. The staff's concern described above regarding how the program will identify cracking is resolved.

Based on its audit, review of the applicant's responses to RAIs B.2.30-1, 3.3.2.2.5-1, 3.3.2.71-2, 3.2.2.1.26-1, and review of the applicant's letters dated August 17, and August 26, 2011, the staff finds that elements one through six of the applicant's One-Time Inspection Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL Report AMP XI.M32 and, therefore, are acceptable.

<u>Operating Experience</u>. LRA Section B.2.30 summarizes operating experience related to the One-Time Inspection Program. In the first operating experience example, the applicant described an instance in which rust and particulate accumulation in the diesel air start compressor and filter components was detected. The applicant described the actions taken to mitigate rust particulates and moisture effects, which included a modification to the system to replace carbon steel piping and components with stainless steel and to add air filters, air dryers, and moisture separators. The applicant stated that subsequent followup inspections confirmed that the modifications were adequate and that no further aging effects were detected in the air start compressor system or downstream components.

In another instance of operating experience, the applicant stated that corrosion attributed to moisture was detected in station air components with a moisture removal function (e.g., aftercooler separator drain trap). The applicant also stated that a corrective action was performed in which the moisture and rust was removed, and the system was modified to include an automatically operating drain. As required by the applicant's corrective actions procedure, followup inspections were conducted to verify that the corrosion issue was resolved.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.30 provides the USAR supplement for the One-Time Inspection Program. The staff reviewed this USAR supplement description of the program and noted that it did not conform to the recommended description for this type of program, as described in SRP-LR, Revision 2, Table 3.0-1, which states that the USAR supplement should state what components this program cannot be used for (i.e., components with known age-related degradation), that this program cannot be applied to environments which are not expected to be equivalent to the prior 40 years, and must include the program enhancements. By letter dated June 20, 2011, the staff issued RAI B.2.30-2 requesting that the applicant include the program's details in the USAR supplement with equivalent information, as recommended in SRP-LR, Revision 2.

In its response dated July 22, 2011, the applicant revised the USAR supplement to state that the One-Time Inspection Program cannot be used for structures or components with known age-related degradation mechanisms or when the environment in the period of extended operation is not expected to be equivalent to that in the prior 40 years. The applicant also added that periodic inspections should be proposed in these cases. The staff finds the applicant's response acceptable because the USAR supplement, as amended, includes an adequate description of the components and environment that can be managed by the program, consistent with the recommendations in SRP-LR, Revision 2. The staff's concern described in RAI B.2.30-2 is resolved.

SRP-LR Section A.1.2.3.10 states that an applicant should commit to a review of future operating experience to confirm the effectiveness of new programs; however, LRA Appendix A.3, Table A-1, "License Renewal Commitment List" does not have a commitment to review future operating experience to confirm the effectiveness of the new One-Time Inspection Program. By letter dated June 20, 2011, the staff issued RAI B.2.30-3 requesting that the applicant commit to perform a review of operating experience in the future to confirm the effectiveness of the program.

In its response dated July 22, 2011, the applicant stated that, in letter dated June 24, 2011, it committed (Commitment No. 43) to:

> Ensure that the current station operating experience review process includes future reviews of plant-specific and industry operating experience to confirm the effectiveness of the license renewal aging management programs, to determine the need for programs to be enhanced, or indicate a need to develop new aging management programs.

The applicant also stated that a separate operating experience commitment for the One-Time Inspection Program is not necessary. The staff finds the applicant's response acceptable because the AMPs will be adequately informed by both industry and plant-specific operating experience for the purpose of maintaining effective aging management, as recommended by the SRP-LR. The staff's concern described in RAI B.2.30-3 is resolved.

The staff also noted that the applicant committed (Commitment No. 13) to implement the new One-Time Inspection Program prior to April 22, 2017, (prior to entering the period of extended operation), for managing aging of applicable components.

The staff determined that the information in the USAR supplement provides 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 One-Time Inspection Program, the staff determined 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. 13, 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR 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 Open-Cycle Cooling Water Program

Summary of Technical Information in the Application. LRA Section B.2.31 describes the existing Open-Cycle Cooling Water Program as consistent, with an exception, with GALL Report AMP XI.M20, "Open-Cycle Cooling Water System." The applicant stated the Open-Cycle Cooling Water Program manages loss of material due to crevice, galvanic, general, pitting, and MIC, and also erosion for certain components. The applicant further stated that the program manages fouling due to particulates and biological material resulting in reduction of heat transfer for heat exchangers and also manages cracking of copper-alloy components. The applicant stated that this program consists of inspections, surveillances, and testing to detect and evaluate these aging effects. The applicant also stated that the program is a combination of condition and performance monitoring with mitigation activities that implements the recommendations of NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M20. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of

GALL Report AMP XI.M20, with the exception of the “scope of program” program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

GALL Report AMP XI.M20 recommends managing the aging effects of loss of material and fouling due to micro- or macro-organisms and various corrosion mechanisms generally found in the open-cycle cooling water system. However, during its audit, the staff found that the applicant’s Open-Cycle Cooling Water Program manages cracking for copper-alloy components with greater than 15 percent Zn. It was not clear to the staff what inspection methods the applicant planned to use to identify cracking of the copper-alloy components exposed to raw water. By letter dated April 20, 2011, the staff issued RAI B.2.31-1 requesting that the applicant clarify what inspection methods will be used to manage cracking of the copper-alloy components with greater than 15 percent Zn that are exposed to open-cycle cooling water.

In its response dated May 24, 2011, the applicant stated that the scope of the Open-Cycle Cooling Water Program was revised so that it would no longer manage cracking of copper alloys exposed to raw water. The applicant further stated that the One-Time Inspection Program will be used to manage cracking of copper alloys with great than 15 percent Zn exposed to raw water. However, the staff questioned whether the One-Time Inspection Program was an appropriate program to manage this aging effect, since one-time inspections are typically used to verify the effectiveness of other programs or to verify that mechanisms are either not occurring or progressing slowly. The applicant’s response to RAI B.2.31-1 did not provide sufficient bases to justify the use of the One-Time Inspection Program. Based on discussions during a teleconference on June 30, 2011, the applicant agreed to revise its response to RAI B.2.31-1.

In its revised response dated July 22, 2011, the applicant provided an entirely new response to RAI B.2.31-1. The applicant stated that cracking due to stress corrosion or IGA in the identified copper alloys in a raw water environment is only a potential aging effect when ammonia or ammonium salt is present. The applicant stated that a review of operating experience did not identify ammonia or ammonium salt in the raw water or cracking of copper alloys in the associated system. Based on this information, in Amendment 12 to the LRA, the applicant revised the Open-Cycle Cooling Water Program to remove cracking as an AERM. The applicant stated that no aging management activities in the Open-Cycle Cooling Water Program will be conducted to manage cracking of the copper-alloy (with greater than 15 percent Zn) components that are exposed to raw water. The staff finds the applicant’s removal of cracking acceptable because the applicant confirmed that the raw water source did not contain ammonia or ammonium salt, which is the main component that would lead to cracking of copper-alloy components in raw water. The staff’s concern described in RAI B.2.31-1 is resolved.

The staff also reviewed the portions of the “monitoring and trending” program element associated with the exception to determine if the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of this exception follows.

Exception 1. LRA Section B.2.31 states an exception to the “monitoring and trending” program element. Rather than conducting testing and inspections annually, the applicant stated that inspection frequencies for the Open-Cycle Cooling Water Program are based on operating conditions and past history, flow rates, water quality, lay-up, and heat exchanger design, in accordance with GL 89-13. The applicant further stated that, in a supplemental response to GL 89-13, it committed to annual heat exchanger inspections for the first three cycles following implementation of GL 89-13, with the option to then determine the best testing frequency based on past history.

The staff reviewed this exception to the GALL Report, Revision 1, and noted that the applicant did not incorporate the recommendation to conduct annual inspections from the "monitoring and trending" program element. However, the staff also noted that the GALL Report, Revision 2, removed this recommendation from GALL Report AMP XI.M20; therefore, the applicant's proposal complies with the current staff position and is acceptable.

Based on its audit, and review of the applicant's responses to RAI B.2.31-1, the staff finds that elements one through six of the applicant's Open-Cycle Cooling Water Program, with an acceptable exception, are consistent with the corresponding program elements of GALL Report AMP XI.M20 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.31 summarizes operating experience related to the Open-Cycle Cooling Water Program. The applicant stated that, in 2007 and 2008, UT measurements identified segments of the service water piping that were below procedural limits. The applicant also stated that these segments met the design requirements and remained operable, but they were being monitored for additional degradation. In addition, the applicant discussed its identification, in 2008, of a silt layer in the service water piping between two system valves related to the auxiliary feedwater (AFW) system. The applicant stated that the piping was subsequently drained and cleaned. The applicant also discussed its identification, in 2009, of corrosion in the supply and return piping to an emergency core cooling system (ECCS) room cooler, which caused high differential pressure. The applicant stated that the piping is being replaced and that it is regularly inspected.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criteria in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.31 provides the USAR supplement for the Open-Cycle Cooling Water Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program, as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2. The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Open-Cycle Cooling Water Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR 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 Head Closure Studs Program

Summary of Technical Information in the Application. LRA Section B.2.34 describes the existing Reactor Head Closure Studs Program as consistent, with enhancement, with GALL Report AMP XI.M3, "Reactor Head Closure Stud Bolting." The applicant stated that the Reactor Head Closure Studs Program manages cracking and loss of material for the reactor head closure stud assemblies (studs, nuts, and washers), and it is a combination mitigative and condition monitoring program. The applicant also stated that the Reactor Head Closure Studs Program examines RV stud assemblies in accordance with the examination and inspection requirements specified in the ASME Code, Section XI, Subsection IWB, and approved ASME Code Cases, and the program includes visual examinations (VT-2) for leak detection performed during system pressure tests. The applicant further stated that the program inspections are implemented by the ISI Program, and the ISI Program complies with the requirements of the ASME Code Section XI edition and addenda incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the inspection interval, subject to prior approval of the edition and addenda by the NRC.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.M3. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.M3, with the exception of the "preventive actions" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The "preventive actions" program element of GALL Report AMP XI.M3 recommends the use of bolting material for closure studs with a measured yield strength less than 150 ksi to reduce the potential for SCC; however, during its audit, the staff found that the applicant's Reactor Head Closure Studs Bolting Program does not rely on using bolting material for closure studs with a measured yield strength less than 150 ksi to mitigate SCC.

By letter dated June 20, 2011, the staff issued RAI B.2.34-01 requesting that the applicant clarify whether the measured yield strength of the reactor head closure stud material used at the site is less than 150 ksi and to add the preventive action that would preclude the future use of material with measured yield strength greater than 150 ksi. If the reactor head closure stud material has a measured yield strength level greater than or equal to 150 ksi, the applicant was asked to justify the adequacy of the AMP to manage SCC in the high-strength material.

In its response to RAI B2.34-1, dated July 22, 2011, the applicant stated that the actual measured yield strength of the closure studs ranges from 151–159 ksi, and the tensile strength ranges from 166–171 ksi. The applicant further stated that an enhancement would be added to the Reactor Head Closure Studs Program to preclude the future use of replacement closure stud bolting fabricated from material with actual yield strength greater than or equal to 150 ksi, except for use of the existing spare reactor head closure stud bolting (two each).

During its review, the staff noted that the applicant's response indicated an exception to the "preventive actions" program element of GALL Report AMP XI.M3. By letter dated August 11, 2011, the staff issued followup RAI B.2.34-2 requesting that (1) the applicant revise the appropriate sections of the LRA to reflect the use of reactor head closure studs with measured yield strength above 150 ksi as an exception to the "preventive actions" program element GALL Report AMP XI.M3, and (2) justify the adequacy of the Reactor Head Closure Stud Program to manage cracking due to SCC of the high-strength bolting material.

In its response to RAI B.2.34-2, dated September 16, 2011, the applicant revised the Reactor Head Closure Studs Program to include an exception to the recommendation to use bolting material for closure studs with actual measured yield strength of less than 150 ksi of the "preventive actions" program element of GALL Report AMP XI.M3. Furthermore, in justifying the adequacy of the program to manage cracking due to SCC, the applicant stated that the Reactor Head Closure Studs Program relies on the implementation of the ISI requirements specified in the ASME B&PV Code, Section XI, which provides for the timely detection of cracks by volumetric examination of each stud during each 10-year ISI Interval. The applicant also stated that it has not detected cracking of the closure studs. The applicant stated that the reactor head closure studs, nuts, and washers are stored in protective racks after removal, and the RV flange holes are plugged with watertight plugs during cavity flooding. The applicant further stated that these methods assure that the flange holes, studs, nuts, and washers are protected from borated water and other potential contaminants during cavity flooding. The applicant further stated that the visible portions of the studs are inspected for boric acid corrosion prior to removal. The staff finds the applicant's response acceptable because (1) the applicant revised the LRA to include an exception to the "preventive actions" program element of the GALL Report AMP XI.M3, and (2) the applicant provided justification for the adequacy of its aging management program to manage cracking due to SCC, despite the stated exception to the GALL Report AMP XI.M3. Therefore the staff's concerns described in RAI B.2.34-2 are resolved. The review of the applicant's justification is provided below in the staff's evaluation of the exception.

The staff also reviewed the portions of the "scope of program" and "preventive actions" program elements associated with the enhancements and exceptions to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements and exception follows.

Enhancement 1. LRA Section B.2.34 states an enhancement to the "scope of program" and "preventive actions" program elements. The applicant stated that this enhancement expands on the existing program element by adding the selection of an alternate stable lubricant that is compatible with the fastener material and the environment. The applicant further stated that a specific precaution against the use of compounds containing sulfur (sulfide) including MoS_2 as a lubricant for the reactor head closure stud assemblies will be included in the program. The applicant also stated that this enhancement will be implemented prior to the period of extended operation.

The staff finds the applicant's enhancement acceptable because it is consistent with the recommendation on the selection of a stable lubricant, as documented in the "preventive action" program element in GALL Report AMP XI.M3.

Enhancement 2. By letter dated July 22, 2011, the applicant stated that an enhancement would be added to the Reactor Head Closure Studs Program to preclude the future use of replacement closure stud bolting fabricated from material with actual yield strength greater than equal to 150 ksi, except for use of the existing spare reactor head closure stud bolting (two each).

The staff finds the applicant's enhancement acceptable because it is consistent with the "corrective actions" element of GALL Report AMP XI.M3.

Exception. As discussed above, by letter dated September 16, 2011, in response to RAI B.2.34-2, the applicant amended LRA Section B2.34, to state that the AMP has an exception to the "preventive actions" program element. GALL Report AMP XI.M3 states that the "preventive actions" program element includes using bolting material for closure studs that has an actual measured yield strength less than 150 ksi. The applicant also stated that the existing reactor head closure studs have actual measured yield strength greater than 150 ksi.

The staff reviewed the applicant's exception, which involves the use of bolting material with actual measured yield strength greater than 150 ksi. As part of its review the staff reviewed the applicant's justification on the adequacy of the AMP to manage SCC in the high-strength material. The staff noted that the applicant takes adequate measures to ensure that the flange holes, studs, nuts, and washers are protected from contaminants that could lead to SCC. The staff also noted that the applicant's program relies on the implementation of the ISI requirements specified in the ASME B&PV Code, Section XI, which provides for volumetric examination of each stud during each 10-year ISI interval. The staff reviewed the applicant's ISI summary reports and noted that past surface and volumetric examinations of the closure studs have not detected any unacceptable indications. Finally, the staff noted that the applicant's "Enhancement 1," when implemented, would render the existing studs less susceptible to SCC during the period of extended operation.

Based on its review, the staff finds the exception acceptable because:

- The applicant takes measures to ensure that closure studs, nuts, washers, and flange holes are protected from contaminants that could lead to SCC.
- Past surface and volumetric examinations of the closure studs have not shown any evidence of SCC.
- The applicant's commitment to use a more stable lubricant during the period of extended operation would render the existing studs less susceptible to SCC.

Based on its audit and a review of the applicant's responses to RAIs B.2.34-1 and B.2.34-2 of the applicant's Reactor Head Closure Studs Program, the staff finds that the program elements one through six for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M3. The staff also reviewed the exception associated with the "preventive actions" program element and its justifications and finds the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the "scope of program" and "preventive actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.34 summarizes operating experience related to the Reactor Head Closure Studs Program. The applicant stated that the Reactor Head Closure Studs Program detects aging effects using nondestructive visual, surface, and volumetric examination techniques to detect and characterize flaws. The applicant conducted a review of its plant-specific operating experience and stated that it has not revealed any reactor head closure stud cracking or loss of material. The applicant described the NDEs of reactor head closure studs performed during two periods for the most recent (third) 10-year inspection interval. These include visual examinations (VT-1) of 36 nuts, 36 washers, and 2 bushings; ultrasonic examination of 36 studs; and ultrasonic examination of 30 sets of threads in the vessel flange. In addition, the applicant stated that visual examination (VT-3) of all 60 studs was performed. The applicant stated that no unacceptable indications were noted in these examinations.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.34 provides the USAR supplement for the Reactor Head Closure Studs Program.

The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.0-1.

The staff also notes that the applicant committed (Commitment No. 16) to enhance the Reactor Head Closure Studs Program prior to April 22, 2017. Specifically, the applicant committed to expand on the existing program element by adding the selection of an alternate stable lubricant that is compatible with the fastener material and the environment. A specific precaution against the use of compounds containing sulfur (sulfide) including MoS_2 as a lubricant for the reactor head closure stud assemblies will be included in the program. In addition, the applicant committed to preclude the future use of replacement closure stud bolting fabricated from material with actual measured yield strength greater than or equal to 150 ksi except for use of the existing spare reactor head closure stud bolting (two each).

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Reactor Head Closure Studs Program, the staff determined 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. 16, prior to the period of extended operation, would make the existing AMP consistent with the GALL Report AMP to which it was compared. In addition, the staff reviewed the exception and its justification, and determined that the AMP, with the exception, is adequate to manage the aging effects. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR 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 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.2.35 describes the existing, “Reactor Vessel Surveillance Program,” as consistent, without exceptions and with one enhancement, with GALL Report AMP XI.M31, “Reactor Vessel Surveillance.” The applicant stated that the Davis-Besse RV Surveillance Program is based on the PWR Owners Group Master Integrated Reactor Vessel Surveillance Program (MIRVSP), which includes all seven operating B&W 177-fuel assembly plants and six participating Westinghouse-designed plants having B&W fabricated RVs.

The MIRVSP is described in topical report BAW-1543 (NP), “Master Integrated Reactor Vessel Surveillance Program,” Revision 4, including the topical report supplements.

The applicant stated that the MIRVSP is an NRC-approved program that implements the requirements of 10 CFR Part 50, Appendix H, “Reactor Vessel Material Surveillance Program Requirements.”

According to the applicant, data resulting from the RV Surveillance Program is used to determine pressure-temperature (P-T) limits, minimum temperature requirements, and end-of-life upper-shelf energy (USE) values in accordance with the requirements of 10 CFR Part 50 Appendix G. It is also used to determine end-of-life reference temperature for pressurized thermal shock (RT_{PTS}) values in accordance with the requirements of 10 CFR 50.61.

The applicant stated that six surveillance capsules containing Davis-Besse plant-specific materials were inserted into the RV before initial plant startup. The first four capsules were withdrawn and tested in accordance with 10 CFR Part 50, Appendix H requirements. The applicant stated that the remaining two capsules, TE1-C and TE1-E, have been removed, and the materials have not been tested. Capsule TE1-C, which contains the Davis-Besse limiting beltline material, has been exposed to neutron fluence slightly greater than the 60-year projected fluence for Davis-Besse. The applicant stated that the RV Surveillance Program will be enhanced to require testing of Capsule TE1-C. The applicant stated that Capsule TE1-E has been discarded.

The applicant stated that the following enhancement would be made to the program—”The Capsule Insertion and Withdrawal Schedule for Davis-Besse will be revised to schedule testing of the TE1-C capsule.”

With respect to the Program’s review and incorporation of industry operating experience, the applicant stated that its participation in the MIRVSP ensures that future operating experience from all participating plants will be factored into the Davis-Besse RV Surveillance Program.

The applicant concluded that the Davis-Besse RV Surveillance Program will adequately manage the reduction in fracture toughness for components of the RV beltline region. The RV

Surveillance Program provides reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the CLB for the period of extended operation.

Staff Evaluation. The staff reviewed the applicant's claim of consistency, without exceptions and with one enhancement, with GALL Report AMP XI.M31. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated. The staff notes that GALL Report AMP XI.M31 does not follow the standard 10-element format of the other GALL Report AMPs but rather provides eight specific elements that an acceptable RV Surveillance Program must meet. Therefore, the staff's evaluation followed the eight elements specific to GALL Report AMP XI.M31 rather than the standard 10-element format. The staff's review of the eight program elements is discussed below.

Element 1. GALL Report AMP XI.31, Element 1, states that the extent of RV neutron embrittlement, with respect to USE and P-T limits, is projected for 60 years, in accordance with RG 1.99, Revision 2. When using RG 1.99, Revision 2, an applicant may use Tables 1 and 2 in RG 1.99, Revision 2 to project the extent of RV neutron embrittlement for the period of extended operation based on materials' copper and nickel content, as described in Regulatory Position (RP) 1 in RG 1.99, Revision 2. Otherwise, the applicant may project RV neutron embrittlement using credible surveillance data based on a best fit to the surveillance data, as described in RP 2 in RG 1.99, Revision 2. It is understood that this specific program element applies to all ferritic RV beltline materials, specifically those ferritic RV pressure boundary materials projected to undergo exposure to high energy neutron fluence greater than 1 x 10^{17} n/cm^2 (E greater than 1.0 MeV) through the end of the period of extended operation.

The Davis-Besse RV Surveillance Program requires that the extent of RV neutron embrittlement—as determined by the USE, RT_{PTS}, and adjusted reference temperature (ART) values for the RV beltline materials—be projected for 60 years in accordance with RG 1.99, Revision 2, and 10 CFR 50.61. Furthermore, the effects of neutron embrittlement on the limiting beltline weld's equivalent margin analysis (EMA) is also projected for 60 years in accordance with ASME Code, Section XI, Appendix K, and 10 CFR Part 50, Appendix G requirements. The Davis-Besse P-T limits are a TLAA that will be managed under the RV Surveillance Program to ensure compliance with TS administrative controls during the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(iii), as described in LRA Section 4.2.4. The staff's review of the P-T limits TLAA is documented in SER Section 4.2.4. The Davis-Besse P-T limit curves are calculated based, in part, on the ART value for the limiting RV beltline material. The staff determined that the applicant's neutron embrittlement projections, as described in LRA Section 4.2, and the applicant's statement in LRA Section B.2.35 that data from the RV Surveillance Program will be used to determine P-T limits and end-of-life USE is consistent with the statement in GALL Element 1 that the extent of RV neutron embrittlement, with respect to P-T limits and USE, is projected for 60 years in accordance with RG 1.99, Revision 2.

The staff's review of the applicants TLAAs for the USE (including the limiting weld EMA), RT_{PTS}, ART, and P-T limits are discussed in SER Sections 4.2.2, 4.2.3, and 4.2.4. Based on its review of these TLAAs, the staff determined that the applicant's USE, RT_{PTS}, and ART projections are acceptable for all RV beltline components. Therefore, the staff determined that the Davis-Besse RV Surveillance Program is consistent with Element 1 from GALL Report AMP XI.M31.

Element 2. GALL Report AMP XI.M31, Element 2, states that determinations of neutron embrittlement for RV beltline materials based on RP 1 in RG 1.99, Revision 2, are subject to the applicable limitations in RP 1.3 of the RG. The limitations are based on material properties, temperature, material chemistry, and neutron fluence. The staff reviewed the applicant's RV Surveillance Program description in LRA Section B.2.35, as well as the TLAAs related to neutron embrittlement projections for RV beltline materials, and determined that the applicant's neutron embrittlement projections based on RP 1 in RG 1.99, Revision 2, are bounded by the subject limitations in RP 1.3 of RG 1.99, Revision 2. Therefore, the staff determined that the applicant's RV Surveillance Program is consistent with GALL Report AMP XI.M31, Element 2.

Element 3. GALL Report AMP XI.M31, Element 3, states that determinations of neutron embrittlement for RV beltline materials using surveillance data are subject to the applicable bounds of the surveillance data, such as neutron fluence and irradiation temperature. The staff determined that the applicant's participation in the MIRVSP, as discussed in LRA Section B.2.35, will ensure that any embrittlement calculations for Davis-Besse's RV using MIRVSP surveillance capsules are appropriately bounded by the applicable exposure parameters of the surveillance data. Only MIRVSP capsule materials that are applicable to Davis-Besse RV beltline materials will be used to monitor embrittlement for the Davis-Besse RV. The exposure conditions of the RV are monitored to ensure that they continue to be consistent with those used to project the effects of embrittlement to the end of the period of extended operation, including the exposure conditions of the applicable MIRVSP surveillance capsules, as discussed in LRA Section B.2.35. Therefore, the staff determined that the applicant's RV Surveillance Program is consistent with GALL Report AMP XI.M31, Element 3.

Element 4. GALL Report AMP XI.M31, Element 4, states that all pulled and tested surveillance capsules, unless discarded before August 31, 2000, shall be placed in storage to be saved for possible reconstitution and use. The MIRVSP requires that all pulled and tested surveillance capsules at participating plants be placed in storage to be saved for possible reconstitution and use.

At Davis-Besse, all six surveillance capsules have been removed from the RV, and four of the capsules were tested prior to August 31, 2000, to comply with 10 CFR Part 50, Appendix H requirements for the current 40-year license term. The two remaining capsules, TE1-C and TE1-E, were removed from the RV and the materials have not been tested. Capsule TE1-C, which contains the limiting beltline material, will be scheduled for testing, in accordance with the enhancement to the RV Surveillance Program, as discussed in LRA Section B.2.35. However, Capsule TE1-E has been discarded.

By letter dated March 17, 2011, the staff issued RAI B.2.35-1 requesting that the applicant provide additional details concerning Capsules TE1-C and TE1-E. The staff stated that in LRA Section B.2.35, the applicant stated that Capsule TE1-C contains the Davis-Besse limiting material and has been exposed to fluence slightly greater than the 60-year projected neutron fluence for Davis-Besse. Therefore, in RAI B.2.35-1, the staff requested that the applicant state whether the limiting material to which the applicant referred in LRA Section B.2.35 is Upper shell to lower shell circumferential weld WF-182-1. The staff also requested that the applicant state the neutron fluence value for Capsule TE1-C. In its response dated April 15, 2011, the applicant stated that the limiting material contained in Capsule TE1-C is upper shell to lower shell circumferential weld WF-182-1. The applicant also stated that the estimated neutron fluence recorded by the MIRVSP for Capsule TE1-C is 1.81×10^{19} n/cm^2 (E greater than 1.0 MeV), and the peak 60-year projected neutron fluence at the inside wetted surface of the RV, as reported in LRA Table 4.2-1, is 1.70×10^{19} n/cm^2 (E greater than 1.0 MeV)

The staff determined that the applicant's response to RAI B.2.35-1 was acceptable because the applicant confirmed that Capsule TE1-C contains Weld WF-182-1, which is the limiting beltline material, with respect to the applicant's USE, EMA, ART, and RT_{PTS} projections, which are discussed in LRA Section 4.2 and reviewed by the staff in SER Section 4.2. It should be noted that, while no heat-specific initial USE data is available for Weld WF-182-1, the applicant determined and the staff agreed that this weld is limiting with respect to projected percentage decrease in USE for the period of extended operation, and an EMA based on material properties projected to 52 effective full power year (EFPY) was required to demonstrate that the weld would remain in compliance with 10 CFR Part 50, Appendix G requirements during the period of extended operation. Furthermore, the staff noted that the surveillance materials in Capsule TE1-C have been exposed to neutron fluence only slightly greater than the peak 52 EFPY RV neutron fluence from LRA Table 4.2-1. Accordingly, the staff determined that the surveillance materials in Capsule TE1-C will provide meaningful metallurgical data for the period of extended operation. The staff's concern described in RAI B.2.35-1 is resolved.

By letter dated March 17, 2011, the staff issued RAI B.2.35-2 requesting that the applicant explain why Capsule TE1-E was discarded, as stated in LRA Section B.2.35. In its response dated April 15, 2011, the applicant stated that Capsule TE1-E was discarded in accordance with the NRC-approved MIRVSP because the specimens in this capsule would not contribute significant data to the MIRVSP. The applicant further stated that the staff was notified on March 17, 2000, by the B&W Owners Group RV Working Group of plans to dispose of irradiated plant-specific materials, including Davis-Besse Capsules TE1-C and TE1-E. The disposal schedule was incorporated into BAW-1543, Revision 4, supplement 4, which was reviewed and approved by the NRC. The NRC SER for supplement 4 is included in BAW-1543-A. The applicant stated that BAW-1543-A, Table IV, page 12, identifies both TE1-C and TE1-E as capsules that will be discarded. However, according to the applicant, BAW-1543-A, Revision 4, supplement 6, page 2, amended the disposal schedule by stating that Capsule TE1-C will likely be tested because it contains the Davis-Besse limiting material and has a fluence between one and two times the peak 52 EFPY projected fluence. The applicant emphasized that Capsule TE1-C will be scheduled for testing by the MIRVSP, as stated in the enhancement to the RV Surveillance Program described in LRA Section B.2.35. Furthermore, the applicant stated that it has committed (Commitment No, 17) to enhance the RV Surveillance Program to schedule testing of Capsule TE1-C, as stated in LRA, Appendix A, Table A-1.

The staff found the applicant's response to RAI B.2.35-2 acceptable because the applicant provided references to MIRVSP documents confirming that Capsule TE1-E was previously slated for disposal. The staff confirmed that the NRC was notified by the B&W Owners Group in a letter dated March 17, 2000, of plans for disposing of Capsule TE1-E. The NRC approved of the capsule disposal plans in effect at that time through its issuance of the SE for BAW-1543, Revision 4, Supplement 4. The staff also acknowledged that the applicant was justified in disposing of Capsule TE1-E because the specimens in the capsule would not contribute significant data to the MIRVSP for B&W plants. The staff's concern described in RAI B.2.35-2 is resolved.

Based on its review of LRA Section B.2.35, MIRVSP documents, and the applicants acceptable RAI responses, as discussed above, the staff determined that, with the exception of Capsule TE1-E, there are currently no pulled and tested surveillance capsules from the Davis-Besse RV that were discarded after August 31, 2000. Furthermore, the MIRVSP requires that all capsules removed from RVs at participating plants be placed in storage to be saved for possible future use, with the exception of those capsules which NRC has previously approved for disposal as part of its review of BAW-1543-A of MIRVSP capsule disposal plans. Therefore, the staff determined that the applicant's RV Surveillance Program is consistent with GALL Report AMP XI.M31, Element 4.

Element 5. GALL Report AMP XI.M31, Element 5, states that if an applicant has a surveillance program that consists of capsules with a projected fluence of less than the 60-year RV fluence at the end of 40 years, at least one capsule is to remain in the RV and is tested during the period of extended operation. The applicant may either delay withdrawal of the last capsule or withdraw a standby capsule during the period of extended operation to monitor the effects of long-term exposure to neutron irradiation.

The staff reviewed the applicant's description of the Davis-Besse RV Surveillance Program in LRA Section B.2.35 and determined that the applicant's participation in the staff-approved MIRVSP ensures that the Davis-Besse RV Surveillance Program is consistent with this program element because the MIRVSP capsule withdrawal schedule is bounded by the above criteria. Furthermore, there are no plant-specific capsules currently remaining in the Davis-Besse RV, and there are no plant-specific capsules with a projected neutron fluence that is less than the 60-year RV fluence at the end of 40 years. The remaining untested capsule has been previously removed and will be scheduled for testing under the MIRVSP, as discussed in the enhancement to the applicant's RV Surveillance Program. Capsule TE1-C has already been exposed to neutron fluence slightly greater than the 60-year RV projected neutron fluence, as discussed above. Therefore, based on its review of the information concerning the status of untested capsules, the staff determined that the applicant's RV Surveillance Program is consistent with GALL Report AMP XI.M31, Element 5, because the withdrawal and planned testing of a capsule with neutron fluence exceeding the 60-year neutron fluence eliminates the need for a capsule to remain in the RV after 40 years.

Element 6. GALL Report AMP XI.31, Element 6, states that if an applicant has a surveillance program that consists of capsules with a projected neutron fluence exceeding the 60-year RV fluence at the end of 40 years, the applicant withdraws one capsule at an outage in which the capsule receives a neutron fluence equivalent to the 60-year RV neutron fluence and tests the capsule in accordance with the requirements of ASTM E 185. Any capsules that are left in the RV shall provide meaningful metallurgical data (i.e., the capsule fluence does not significantly exceed the RV fluence at an equivalent of 60 years). Other standby capsules are removed and placed in storage. These standby capsules (and archived test specimens available for reconstitution) would be available for reinsertion into the reactor if additional license renewals are sought (e.g., 80 years of operation). If all surveillance capsules have been removed, operating restrictions are to be established to ensure that the plant is operated under conditions to which the surveillance capsules were exposed. The exposure conditions of the RV are monitored to ensure that they continue to be consistent with those used to project the effects of embrittlement to the end-of-life. If the RV exposure conditions (e.g., neutron flux, spectrum, irradiation temperature) are altered, then the basis for the projection to 60 years is reviewed; and, if deemed appropriate, an active surveillance program is re-instituted. Any changes to the RV exposure conditions and the potential need to re-institute a vessel surveillance program is discussed with the staff prior to changing the plant's licensing basis.

The staff reviewed the applicant's description of the Davis-Besse RV Surveillance Program in LRA Section B.2.35 and determined that the applicant's participation in the staff-approved MIRVSP ensures that the Davis-Besse RV Surveillance Program is consistent with this program element because the MIRVSP withdrawal schedule is bounded by the above criteria. Furthermore, all Davis-Besse capsules have been removed, and Capsule TE1-C, which has already been exposed to neutron fluence slightly greater than the 60-year projected fluence for Davis-Besse, will be scheduled for testing under the MIRVSP, as stated in the enhancement to the RV Surveillance Program.

The Davis-Besse RV Surveillance Program requires the monitoring of RV exposure conditions to ensure that they continue to be consistent with those used to project the effects of embrittlement to the end-of-life. Therefore, based on its review of the information provided in LRA Section B.2.35 concerning the status of untested capsules, the staff determined that the applicant's RV Surveillance Program is consistent with GALL Report AMP XI.M31, Element 6.

Element 7. GALL Report AMP XI.M31, Element 7, states that applicants without in-vessel capsules use alternative dosimetry to monitor neutron fluence during the period of extended operation, as part of the program for RV neutron embrittlement. There are no capsules remaining in the Davis-Besse RV. The applicant stated that ex-vessel cavity dosimetry is used to monitor neutron fluence, since Davis-Besse does not have any surveillance capsules remaining inside the RV. The staff determined that the applicant's use of ex-vessel cavity dosimetry is acceptable for monitoring neutron fluence at Davis-Besse during the period of extended operation. Therefore, staff found that the Davis-Besse RV Surveillance Program is consistent with GALL Report AMP XI.M31, Element 7.

Element 8. GALL Report AMP XI.M31, Element 8, states that the applicant may choose to demonstrate that the materials in the RV inlet, outlet, and safety injection nozzles (including nozzle-to-shell welds) are not controlling, so that such materials need not be added to the material surveillance program for the license renewal term. Based on its review, as documented in SER Section 4.2, of the LRA Section 4.2, "Reactor Vessel Neutron Embrittlement," TLAAs, the staff determined that none of the Davis-Besse RV beltline nozzle forgings or nozzle-to-shell weld materials are controlling with respect to either the projected 52 EFPY ART, RT_{PTS}, or USE values. Therefore, staff found that GALL Report AMP XI.M31, Element 8, is satisfied for Davis-Besse.

The staff also reviewed the portions of the "monitoring and trending" program element associated with enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement 1. LRA Section B.2.35 describes the following enhancement to the "monitoring and trending" program element: "The Capsule Insertion and Withdrawal Schedule for Davis-Besse will be revised to schedule testing of the TE1-C capsule."

The staff found this enhancement to be acceptable because it makes the Davis-Besse RV Surveillance Program consistent with Element 6 of GALL Report AMP XI.M31, which requires an applicant with a surveillance program that consists of capsules with a projected neutron fluence exceeding the 60-year RV fluence at the end of 40 years, to withdraw one capsule at an outage in which the capsule receives a neutron fluence equivalent to the 60-year RV neutron fluence, and to test the capsule in accordance with the requirements of ASTM E 185. Further details on this enhancement are discussed in the staff's evaluation of Elements 5 and 6 above.

Based on its review of the program description in the LRA and its review of the applicant's responses to RAIs B.2.35-1 and B.2.35-2, the staff finds that elements one through six of the applicant's RV Surveillance Program, with one acceptable enhancement, are consistent with the corresponding program elements of GALL Report AMP XI.M31 and, therefore, are acceptable.

Since the applicant's RV Surveillance Program is based on NRC-approved topical report BAW-1543 (NP), "Master Integrated Reactor Vessel Surveillance Program," Revision 4, the staff reviewed its SE of the topical report to determine if there were any license renewal action items that must be fulfilled by the applicant. The staff determined there were no license renewal action items applicable to Davis-Besse.

Based on its review of the Davis-Besse RV Surveillance Program, as described in LRA Section B.2.35, including the applicant's RAI responses, as discussed above, the staff determined that the Davis-Besse RV Surveillance Program is acceptable for managing the reduction in fracture toughness for components of the RV beltline region during the period of extended operation. The staff also determined that the Davis-Besse RV Surveillance Program provides reasonable assurance that the effects of neutron embrittlement on the RV beltline components will be managed such that these components will continue to perform their intended functions consistent with the CLB during the period of extended operation.

Operating Experience. LRA Section B.2.35 summarizes operating experience related to the RV Surveillance Program. The applicant stated that its review of plant and industry operating experience provides reasonable assurance that the RV Surveillance Program will be effective in managing the effects of aging so that components within the scope of the program will continue to perform their intended function, consistent with the CLB, during the period of extended operation. The applicant further stated that Davis-Besse participates in the MIRVSP, as described in reports BAW-1543(NP), including all supplements to this document. The applicant stated that participation in the MIRVSP ensures that future operating experience from all participating plants will be factored into the RV Surveillance Program. The staff determined that the MIRVSP is an acceptable program for implementation at Davis-Besse.

The staff reviewed operating experience information in LRA Section B.2.35 to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. Based on its review of the application and the NRC-approved MIRVSP documents, which are included in BAW-1543(NP), Revision 4, including Supplements 1–6, the staff determined that the operating experience indicates that the applicant's program will be effective in managing aging effects during the period of extended operation. As discussed in SER Section 4.2.2, the staff determined that the applicant correctly applied credible surveillance data for adjusting the projected 52 EFPY USE values for RV beltline forging BCC 241 and Weld WF-182-1, in accordance with RG 1.99, Revision 2, RP 2.2. The staff also determined, as discussed in SER Sections 4.2.3 and 4.2.4, that the applicant correctly determined the surveillance data was not credible for determining 52 EFPY RT_{PTS} and nil-ductility reference temperature (RT_{NDT}) values. Accordingly, the staff determined that this demonstrates that the applicant is correctly addressing the relevant operating experience, with respect to correctly using credible surveillance data, while not using non-credible data, for adjusting end-of-life RV embrittlement parameters (USE, RT_{NDT}, and RT_{PTS}).

Based on its review of the application, the staff finds that operating experience related to the applicant's RV Surveillance Program demonstrates that it can adequately manage the effects of neutron embrittlement on the RV beltline materials at Davis-Besse. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.35 provides an USAR supplement description for the RV Surveillance Program.

The staff reviewed the USAR supplement description of the program and noted that it does not conform to the recommended description of this type of program, as described in SRP-LR Table 3.1-2. However, the staff determined that the USAR supplement description of this program does ensure that that this program will continue to comply with 10 CFR Part 50, Appendix H and ASTM E 185-82 requirements during the period of extended operation because the USAR supplement discusses the applicant's participation in the MIRVSP during the period of extended operation, and the MIRVSP will comply with 10 CFR Part 50, Appendix H and ASTM E 185-82 requirements during the period of extended operation, as documented in the staff's SEs for BAW-1543(NP), Revision 4, including all supplements for BAW-1543(NP), Revision 4. Therefore, the staff determined that the USAR supplement description of this program is acceptable.

The staff also notes that the applicant provided a commitment in LRA Appendix A, Table A-1 (Commitment No. 17) to enhance the RV Surveillance Program to require that the capsule insertion and withdrawal schedule for Davis-Besse be revised to schedule testing of the TE1-C capsule. The commitment to enhance the RV Surveillance Program will be implemented prior to entering the period of extended operation.

Conclusion. On the basis of its review of the applicant's RV Surveillance Program, the staff determined that the program elements for which the applicant claimed consistency with the GALL Report are consistent. Additionally, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 17, prior to the period of extended operation, would make the existing program consistent with GALL Report AMP XI.M31. Therefore, the staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this program 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 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.39 describes the existing Structures Monitoring Program as being consistent, with enhancements, with GALL Report AMP XI.S6, "Structures Monitoring Program." The applicant stated that the Structures Monitoring Program is part of the Maintenance Rule Program. It is an existing program that is designed to ensure age-related degradation of the plant structures and structural components within its scope are managed such that each structure and structural component retains its ability to perform its intended function. The Maintenance Rule Program is comprised of many existing monitoring and assessment activities that collectively address potential and actual degradation conditions and their effects on the reliability of SCs. The applicant stated that AMP B.2.39, "Structures Monitoring Program," encompasses and implements the Water Control Structures Inspection and the Masonry Wall Inspection Programs. The Structures Monitoring Program implements provisions of the Maintenance Rule, 10 CFR 50.65, which relate to structures, masonry walls, and water control structures. It conforms to the guidance contained in RG 1.160 and NUMARC 93-01. Concrete, masonry walls, and other structural components that perform a fire barrier intended function are also managed by the Fire Protection Program. Although protective coatings are not relied upon nor credited in license renewal to manage the effects of aging for structural components, protective coatings in the containment are inspected as part of the Structures Monitoring Program and Nuclear Safety-Related Protective Coatings Program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.S6. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.S6 with the exception of "preventive action," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria." For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

While reviewing the "preventive action" program element, the staff noted that the LRA did not discuss the use of ASTM A325, ASTM F1852, or ASTM A490 bolts and the associated preventive actions recommended in "Specification for Structural Joints Using ASTM A325 or A490 Bolts." A recent staff review determined that if ASTM A325, ASTM F1852, or ASTM A490 bolts are used, the preventive actions as discussed in Section 2 of the Research Council for Structural Connections (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts" should be followed. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.39-8, asking the applicant to explain how the preventive actions discussed in Section 2 of "Specification for Structural Joints Using ASTM A325 or A490 Bolts" are addressed if ASTM A325, ASTM F1852, or ASTM A490 bolts are used within the scope of license renewal.

In its response dated May 24, 2011, the applicant stated that ASTM A325 and A490 bolts are used at Davis-Besse. The applicant also stated that the current edition of the specification used onsite does not include the preventive actions discussed in Section 2 of the recommended RCSC standard. Therefore, the applicant added a new commitment (Commitment No. 31) to incorporate the preventive actions of the RCSC specification into the site specifications and implementing procedures that address structural bolting within the scope of license renewal.

The staff reviewed the response and finds it acceptable because the applicant committed to incorporate the proper preventive actions into the implementing procedures for structural bolting. This will make the applicant's "preventive action" program element consistent with the guidance in the corresponding element of the GALL Report and, therefore, acceptable. The staff's concern described in RAI B.2.39-8 is resolved.

While reviewing the "parameters monitored or inspected" program element, the staff noted that the chemical parameters for the applicant's groundwater are considered to be aggressive (i.e., chlorides = 2,870 ppm (max) and sulfates = 1,700 ppm (max)). For Program Element 10, "Operating Experience," of the Structures Monitoring Program the LRA states that the turbine building has active water in-leakage, and evidence of water in-leakage was observed in several locations in the floor and walls of the turbine building by the staff during an audit-related plant walkdown. Also, program basis documentation has identified groundwater intrusion into the ECCS pump room and ECCS cooler room, the east condenser pit through various joints and seams in the east wall below the condensate storage tank (CST), efflorescence in the south and east exterior walls of room 121 of the auxiliary building, and the annulus sand pocket. Indications of in-leakage of groundwater were also observed at an overhead joint in the service water tunnel during a plant walkdown. LRA Section B.2.39 states that the Structures Monitoring Program will be enhanced to require the responsible engineer to review the raw water chemistry for unusual trends during the period of extended operation, raw water chemistry will be collected at least once every 5 years with data collection staggered to account for seasonal variations, and monitoring of below-grade inaccessible concrete components will be implemented before the period of extended operation. However, it is unclear to the staff that inaccessible concrete components have not been adversely impacted by the aggressive groundwater and when an examination of an inaccessible concrete component will be conducted.

By letter dated April 5, 2011, the staff issued RAI B.2.39-3, asking the applicant to do the following:

- Provide background information and data to demonstrate that the concrete and steel reinforcement subjected to aggressive groundwater is not degrading. If an opportunistic inspection of an affected inaccessible concrete component will be conducted to demonstrate structural adequacy prior to the period of extended operation, provide details about the inspection, including the proposed schedule and an explanation of how the inspection will demonstrate the acceptability of affected concrete throughout the plant.
- Explain how the Structures Monitoring Program, or other plant-specific program, will address aggressive groundwater infiltration to ensure that resulting aging effects, especially in any inaccessible areas, will be effectively managed during the period of extended operation.

In its response dated May 24, 2011, the applicant stated that there is no evidence that the aggressive groundwater at Davis-Besse has contributed to structural degradation. However, the applicant revised Commitment No. 20 to include a concrete core bore from a representative inaccessible structure subjected to aggressive groundwater prior to entering the period of extended operation. Depending on the results of the initial core bore, the need for additional samples and additional locations will be evaluated.

The staff reviewed the applicant's response and found it unacceptable. Although the applicant committed to taking a core bore, the response did not provide details about when the core would be taken, where it would be taken, what would be included in the evaluation of the core, or the acceptance criteria that would be used to determine adequacy of affected concrete. Therefore, by letter dated July 21, 2011, the staff issued follow up RAI B.2.39-11 asking the applicant to provide additional information about the concrete core, including the timing, location, and tests to be completed on the core.

In its response dated August 26, 2011, the applicant stated that it plans to investigate the effect of site groundwater on reinforced concrete structures using invasive testing and visual inspection. The applicant stated that it plans to take two core bores prior to entering the period of extended operation: one from the inside of the east wall of the turbine building condenser pit at approximately 573-ft elevation and one from the auxiliary building ECCS pump room No. 1 floor at approximately 545-ft elevation. In addition, the applicant plans to expose reinforcing steel at these locations to inspect for corrosion, collect samples, measure wastage and corrosion buildup, and evaluate cracking. The applicant further stated that it plans to subject the core bore samples to petrographic examination to determine chemical effects on the concrete and conduct compressive strength tests for comparison with the original concrete design strength. ACI 349.3R-02 will be used as a reference for acceptance criteria for specific inspection and testing results. The applicant committed to these actions by April 22, 2017, and revised Commitment No. 20 accordingly.

The staff reviewed the applicant's response and was not clear why the applicant was waiting until the period of extended operation (2017) when core bores could be taken prior to entering the period of extended operation. The staff finds that earlier cores would allow for an adequate 'baseline' understanding of the condition prior to entering the period of extended operation. Therefore, the staff held a teleconference with the applicant on September 13, 2011, to discuss the adequacy of the timing of the concrete bores. In response to the discussion, the applicant supplemented its response by letter dated October 7, 2011. In the response the applicant deleted the requirement for core bores from Commitment No. 20 and added Commitment No. 26 to complete the core bores by the end of 2014.

The staff reviewed the applicant's response, and the associated supplement, and finds it acceptable because the applicant committed (Commitment No. 26) to taking two core bores by the end of 2014 at locations known to have had extended groundwater infiltration. In addition, the applicant plans to subject the core bore samples to petrographic examination to determine the chemical effects on concrete. If degradation is detected, the applicant will enter it into the Corrective Action Program, and if no degradation is detected, the core bores provide assurance that concrete exposed to groundwater leakage will continue to perform its intended function during the period of extended operation. Finally, the applicant will use ACI 349.3R-02 as a reference for acceptance criteria in determining the adequacy of the affected concrete, which is consistent with recommendations in the GALL Report and, therefore, acceptable. The staff finds that the timing of the cores is acceptable because there have been no visual indications of significant degradation to date and the cores will be completed prior to the period of extended operation. The staff's concerns described in RAIs B.2.39-3 and B.2.39-11 are resolved.

While reviewing the "detection of aging effects" program element, the staff noted that the structures are periodically monitored to identify degradation that could impair the functional performance of the structure. Visual inspection is the method used for monitoring the structural degradation. The inspections are performed by maintenance rule walkdown teams consisting of at least two individuals that are degreed engineers, or equivalent, and have at least 5 years' experience in civil/structural engineering activities, or as determined by the mechanical/structural supervisor. At least one member of the maintenance rule walkdown team is a licensed professional engineer. It is unclear to the staff whether personnel performing the inspections are commensurate with industry codes, standards, and guidelines for inspectors, as recommended by the GALL Report (i.e., American Concrete Institute (ACI) 349.3R-96 and ANSI/American Society of Civil Engineers (ASCE) 11-90 provide an acceptable basis for addressing inspector qualifications).

By letter dated April 5, 2011, the staff issued RAI B.2.39-4, asking the applicant to provide qualifications of the personnel performing the inspections and show that they are commensurate with industry codes, standards, and guidelines (e.g., ACI 349.3R Section 7).

In its response dated May 24, 2011, the applicant stated that the LRA was revised to enhance the Structures Monitoring Program to require that personnel performing the structural inspections meet qualifications that are commensurate with ACI 349.3R (Commitment No. 20).

The staff reviewed the response and finds it acceptable because the applicant committed to enhance the inspector qualification requirements to be commensurate with ACI 349.3R. This commitment will make the applicant's "detection of aging effects" program element consistent with the relevant guidance in the corresponding element of the GALL Report and, therefore, acceptable. The staff's concern described in RAI B.2.39-4 is resolved.

While reviewing the "detection of aging effects" program element, the staff noted that the Structures Monitoring and Masonry Wall Programs periodically monitor the structures through visual inspections to identify degradation that could impair the functional performance of the structure. The standard interval between periodic assessments for a particular structure is 4 years, but the frequency can vary from 2–10 years depending on the location and environment, susceptibility to degradation, and the age of the structure. It is unclear to the staff that the inspection frequency meets the recommendations of the GALL Report that structures within the scope of license renewal should be monitored on a frequency not to exceed 5 years.

By letter dated April 5, 2011, the staff issued RAI B.2.39-5, asking the applicant to identify structures and masonry walls that will be inspected on a frequency greater than 5 years, along with their environments and a summary of past degradation. The staff also requested a technical justification for any inspection interval greater than 5 years.

In its response dated May 24, 2011, the applicant revised the LRA to specify that structures within the scope of the program be inspected at least once every 5 years, with provisions for more frequent inspections if necessary (Commitment No. 20). The staff finds this response acceptable because it aligns the applicant's program with the recommendations in the GALL Report for an appropriate inspection interval. The staff's concern described in RAI B.2.39-5 is resolved.

To address concerns regarding volumetric inspections of high-strength bolts identified during the staff's review of the applicant's Bolting Integrity Program, the staff issued a series of RAIs. A detailed discussion of the RAI's and the staff's review can be found in the staff's evaluation of the Bolting Integrity Program documented in Section 3.0.3.2.2 of this SER. Based on the review, by letter dated January 21, 2013, the applicant updated the "preventive actions" and "detection of aging effects" program elements to include volumetric inspections of high-strength structural bolts exposed to a corrosive environment. The applicant also updated Commitment No. 20 to reflect these changes and to prevent future use of A540 bolts with measured yield strength equal to or greater than 150 ksi. By letter dated March 14, 2013, the applicant also updated the USAR Supplement in LRA Section A.1.39 to clearly state that high-strength structural bolts will be volumetrically inspected.

The staff reviewed the revisions to the program elements, Commitment No. 20 and the USAR Supplement and finds them acceptable because the applicant clearly explained how a corrosive environment will be identified and stated that high-strength bolts within the scope of license renewal will be volumetrically inspected on an acceptable frequency if they are exposed to a corrosive environment. This aligns the program with the guidance provided in the GALL Report. As noted above, additional information on this issue can be found in the staff's review of the Bolting Integrity Program, Section 3.0.3.2.2 of this SER.

While reviewing the "acceptance criteria" program element, the staff noted that the applicant's inspection criteria used to assess the condition of structures and structural components are found in Maintenance Rule evaluation procedure for the Maintenance Rule Evaluation of Structures. Evaluation criteria follow guidance contained in NEI 96-03, "Guideline for Monitoring the Condition of Structures at Nuclear Power Plants." Plant basis documentation identifies acceptance criteria such as Y (structure/area/room acceptable, no design basis violation, housekeeping may or may not be required), W (structure/area/room acceptable with deficiencies), and N (structure/area/room unacceptable). Little in the way of quantitative inspection criteria are provided, and at least one example of criteria provided does not meet ACI 349.3R requirements (i.e., crack widths less than 0.0625 in. as acceptable whereas ACI lists crack widths less than 0.015 in. as acceptable). It is unclear to the staff what quantitative acceptance criteria are used or that acceptance criteria used align with recommended guidance, such as ACI 349.3R.

By letter dated April 5, 2011, the staff issued RAI B.2.39-6, asking the applicant to do the following:

- Provide the quantitative acceptance criteria for the Structures Monitoring Program. If the concrete acceptance criteria deviate from those discussed in ACI 349.3R, provide technical justification for the differences.

- If quantitative acceptance criteria will be added to the programs as an enhancement, provide plans and a schedule to conduct a baseline inspection with the quantitative acceptance criteria prior to the period of extended operation.

In its response dated May 24, 2011, the applicant revised the LRA to include an enhancement and commitment (Commitment No. 20) to include quantitative acceptance criteria based on the guidance in ACI 349.3R. The applicant also committed (Commitment No. 21) to conduct a baseline inspection of the structures within the scope of license renewal, using the quantitative acceptance criteria, prior to entering the period of extended operation.

The staff reviewed the applicant's response and finds it acceptable because the applicant committed to develop quantitative acceptance criteria based on ACI 349.3R and to conduct a baseline inspection prior to the period of extended operation. These commitments will make the applicant's "acceptance criteria" program element consistent with the guidance in the corresponding element of the GALL Report and, therefore, acceptable. The staff's concern described in RAI B.2.39-6 is resolved.

The staff also reviewed the portions of the "scope," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements follows.

Enhancement 1. LRA Section B.2.39 states an enhancement to the "scope of program" that expands on the existing program element by adding structures or to provide clarification to the following structures:

- BWST foundation
- diesel oil storage tank foundation
- duct banks, cable and pipe trenches, and manholes located in the yard
- EDG fuel oil storage tanks foundation
- fire hydrant hose houses and foundations
- fire walls between bus-tie transformers, between bus-tie and startup transformer 01, and between auxiliary and main transformers
- fire water storage tank foundation
- miscellaneous DG building fire wall
- service water discharge structure
- SBO component foundations and structures in the yard and switchyard (startup transformers 01 and 02, bus-tie transformers, 345 kV switchyard circuit breakers ACB34560, ACB34561, ACB34562, ACB34563, ACB34564, air break switch ABS34625, relay house, "J" and "K" buses)
- SBODG building (including transformer X-3051 foundation and radiator skid foundation)

The staff finds this enhancement acceptable because, when implemented, the Structures Monitoring Program will address the structures included within the scope of license renewal. This enhancement will make the "scope of program" program element of the applicant's

Structures Monitoring Program more consistent with the "scope of program" program element recommendations provided in GALL Report AMP XI.S6, "Structures Monitoring Program."

Enhancement 2. LRA Section B.2.39 states an enhancement to the "parameters monitored or inspected" that expands on the existing program element by including aging effect terminology (e.g., loss of material, cracking, change in material properties, and loss of form).

The staff finds this enhancement acceptable because, when implemented, this enhancement will include aging effect terminology that adds clarification to the aging effects of interest. This helps ensure that the degradation parameters monitored and inspected by the Structures Monitoring Program that could lead to loss of intended functions will be detected. This enhancement will make the "parameters monitored or inspected" program element of the applicant's program more consistent with the "parameters monitored or inspected" program element recommendations provided in GALL Report AMP XI.S6, "Structures Monitoring Program."

Enhancement 3. LRA Section B.2.39 states an enhancement to "parameters monitored or inspected" that expands on the existing program element by listing ACI 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," and ANSI/ASCE 11-90, "Guideline for Structural Condition Assessment of Existing Buildings," as references and to indicate that they provide guidance for the selection of parameters monitored or inspected.

The staff finds this enhancement acceptable because, when implemented, this enhancement will add clarification to the guidance used for selection of parameters monitored or inspected. This enhancement will make the "parameters monitored or inspected" program element of the applicant's Structures Monitoring Program more consistent with the "parameters monitored or inspected" program element recommendations provided in GALL Report AMP XI.S6, "Structures Monitoring Program."

Enhancement 4. LRA Section B.2.39 states an enhancement to "parameters monitored or inspected" that expands on the existing program element by providing clarification that a "structural component" for inspection includes each of the component types identified within the scope of license renewal as requiring aging management.

The staff finds this enhancement acceptable because, when implemented, this enhancement will add clarification to the "parameters monitored or inspected" program element by identifying the component types that comprise the structural components for inspection. This enhancement will make the "parameters monitored or inspected" program element of the applicant's Structures Monitoring Program more consistent with the "parameters monitored or inspected" program element recommendations provided in GALL Report AMP XI.S6, "Structures Monitoring Program."

Enhancement 5. LRA Section B.2.39 states an enhancement to "parameters monitored or inspected" that expands on the existing program element by noting that the Structures Monitoring Program procedure will be enhanced by requiring the responsible engineer to review site raw water pH, chlorides, and sulfate test results prior to the inspection to take into account the raw water chemistry for any unusual trends during the period of extended operation. The LRA states that raw water chemistry data shall be collected at least once every 5 years. The LRA further states that data collection dates shall be staggered from year to year (summer-winter-summer) to account for seasonal variation.

The staff finds this enhancement acceptable because, when implemented, this enhancement will add clarification to the “parameters monitored or inspected” program element relative to the parameters to be monitored during the period of extended operation. Raw water monitoring may act as a leading indicator of any possible negative trends in changes in site groundwater chemistry. As noted in Enhancement 6, the site groundwater is aggressive and is being considered aggressive throughout the period of extended operation; therefore, no sampling is being done of the groundwater.

Enhancement 6. LRA Section B.2.39 states an enhancement to “parameters monitored or inspected” that expands on the existing program element by adding a special provision to monitor below-grade inaccessible concrete components before and during the period of extended operation. The LRA states that a below-grade examination of an in-scope concrete structure below 570-ft elevation (groundwater elevation) will be performed prior to the period of extended operation and evaluated using acceptance criteria from GALL Report AMP XI.S6, Program Element 6. The LRA also notes that the site groundwater is aggressive per the GALL Report limits; however, there is no evidence that the groundwater has contributed to structural degradation. This inspection will help verify that during the period of extended operation.

The staff found this enhancement acceptable because, when implemented, this enhancement will add clarification to the “parameters monitored or inspected” program element relative to the component types to be monitored during the period of extended operation and will make the program more consistent with the GALL Report recommendations for plants having aggressive groundwater/soil relative to examination of the exposed portions of the below-grade concrete, when excavated for any reason. This enhancement will help provide assurance that the aggressive site groundwater is not contributing to degradation and that any aging degradation will be detected and quantified before there is a loss of intended functions. This issue is discussed in detail above, in response to RAIs B.2.39-3 and B.2.39-11.

Enhancement 7. LRA Section B.2.39 states an enhancement to “parameters monitored or inspected” that expands on the existing program element by specifying that, upon notification that a below-grade concrete structural wall or other in-scope concrete structural component will be accessible through excavation, a followup action is initiated to the responsible engineer to inspect the exposed surfaces for age-related degradation using acceptance criteria from GALL Report AMP XI.S6, Program Element 6.

The staff found this enhancement acceptable because, when implemented, this enhancement will add clarification to the “parameters monitored or inspected” program element relative to the component types to be monitored during the period of extended operation and will make the program more consistent with the GALL Report recommendations for plants having aggressive groundwater/soil relative to examination of the exposed portions of the below-grade concrete, when excavated for any reason. This enhancement will help provide assurance that the aging degradation will be detected and quantified before there is a loss of intended functions.

Enhancement 8. LRA Section B.2.39 states an enhancement to “detection of aging effects” that expands on the existing program element by listing ACI 349.3R-96, “Evaluation of Existing Nuclear Safety-Related Concrete Structures,” ANSI/ASCE 11-90, “Guideline for Structural Condition Assessment of Existing Buildings,” and EPRI Report 1007933, “Aging Assessment Field Guide,” as references and to indicate that they provide guidance for detection of aging effects.

The staff found this enhancement acceptable because, when implemented, this enhancement will add clarification to the “detection of aging effects” program element relative to guidance that will be used to provide an acceptable basis for addressing detection of aging effects. However, specific acceptance criteria and inspection intervals listed in the LRA do not meet the recommendations provided in these documents relative to personnel qualification, inspection frequency, and acceptance criteria. These items were addressed previously in RAIs B.2.39-4, B.2.39-5, and B.2.39-6, respectively.

Enhancement 9. LRA Section B.2.39 states an enhancement to "monitoring and trending" that expands on the existing program element by including requirements to follow the documentation requirement of 10 CFR 54.37 and to submit records of structural evaluations to records management.

The staff finds this enhancement acceptable because the Structures Monitoring Program will meet the requirements of 10 CFR Part 50, Appendix B, for program confirmation process and administrative control.

Enhancement 10. LRA Section B.2.39 states an enhancement to "acceptance criteria" that expands on the existing program element by indicating that ACI 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," provides acceptable guidelines that will be considered in developing acceptance criteria for concrete structural elements, steel liners, joints, coatings, and waterproofing membranes.

The staff finds the enhancement acceptable because the Structures Monitoring Program will consider acceptance guidelines in ACI 349.3R-96. However, the LRA notes that inspection criteria used to assess the condition of structures and structural components are found in the Maintenance Rule Evaluation of Structures, and these inspection criteria do not align with industry-accepted codes and standards. This item was addressed previously under RAI B.2.39-6.

Based on its onsite audit and review of the applicant's response to the RAIs, the staff finds that elements one through six of the applicant's Structures Monitoring Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL Report AMP XI.S6 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.39 summarizes operating experience related to the Structures Monitoring Program. Three general areas were identified based on a review of onsite documentation and the LRA—concrete spalling, groundwater in-leakage, and boric acid leakage/corrosion. In the LRA and associated onsite documentation, the applicant stated that the AFW pump turbine exhaust tornado missile barrier has spalled concrete and exposed rebar due to its periodic exposure to a harsh environment. The walls were grouted and painted under work order No. 200324374. The applicant stated that the auxiliary building has various small spalled areas and surface cracks, and efflorescence was noted in several areas with no active leakage. The applicant also stated that inspection of the 345 kV switchyard noted several tower concrete foundations to be structurally degraded. The foundations had significant concrete spalling and several had exposed steel reinforcement. The applicant also stated that groundwater intrusion had been detected in the ECCS pump room and ECCS cooler room. Calcium deposits were noted in the wetted areas on the walls and the floor. The applicant also stated that groundwater is leaking into the east condenser pit through various joints and seams in the east wall below the CST room. Efflorescence due to groundwater leakage has also been observed through the south and east exterior walls of room 121 of the auxiliary building. The applicant also stated that boric acid residue and general corrosion has occurred on supports in containment. The applicant further stated that these issues have been addressed under the Corrective Action Program.

The staff reviewed operating experience information, in the application and during the onsite audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience that could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification that resulted in the issuance of three RAIs.

A review of program basis documentation related to Program Element 10, "Operating Experience," noted that during Maintenance Rule Evaluation of Structures Inspections boric acid deposits had been observed over a large surface area of the containment incore instrumentation tunnel walls and the under-vessel area that are indicative of refueling canal leakage. This included numerous boric acid indications on the concrete and on structural members below the elevation of the refueling cavity. It was also noted that the leakage was coming through the reinforced concrete construction joints and shrinkage cracks, running down the wall to the floor, and, in some places, under the grating in the tunnel. It is unclear to the staff whether the effects of refueling cavity leakage on the containment internal concrete structures have been adequately addressed and if the possible aging effects will be properly managed during the period of extended operation.

By letter dated April 5, 2011, the staff issued RAI B.2.39-1 requesting that the applicant do the following:

- Provide background information or data or both to demonstrate that the concrete and embedded steel reinforcement potentially exposed to the prior borated water leakage have not been degraded.
- Discuss any remedial actions or repairs that are planned to address refueling cavity leakage and when they will be implemented. In the absence of a commitment to stop the refueling cavity leakage, explain how the Structures Monitoring Program, or other plant-specific program, will address the refueling cavity leakage to ensure that resulting aging effects, especially in any inaccessible areas, will be effectively managed during the period of extended operation.

In its response dated May 24, 2011, the applicant stated that, in 2003, an extensive investigation determined that there was no concern with the structural integrity of the affected structures. The investigation involved destructive testing, including five core bores. The applicant further stated that the leakage was still occurring and committed (Commitment No. 33) to "continue to reduce or mitigate the refueling canal leaks inside containment prior to entering the period of extended operation."

The staff reviewed the applicant's response and found it unacceptable. Although the applicant committed to reduce or mitigate the leakage, the plan is vague and does not contain any information on possible techniques or timeframes. The commitment also does not address what actions would be taken if the applicant were unable to stop the leakage. In addition, the applicant's response stated that the leakage has continued during outages since 2003; however, no explanation was provided as to why the 2003 results remained applicable after 8 years or how the applicant planned to confirm the integrity of the affected structures prior to entering the period of extended operation. Therefore, by letter dated July 21 2011, the staff issued follow up RAI B.2.39-9 requesting the applicant to provide additional information about the refueling canal leakage to include the following:

- information about how the integrity of affected structures will be confirmed
- additional information about the timeframe and mitigation methods associated with the commitment to stop the leakage
- information about how commodities exposed to the borated water leakage (e.g., supports, piping) would be managed during the period of extended operation

In its response, dated September 16, 2011, the applicant committed (Commitment No. 33) to performing a core bore in an area known to have past borated water leakage. The core would be subjected to testing, and reinforcement steel would be exposed for examination. The applicant further stated that if they were unable to stop the leakage, the concrete bores would be repeated 6 years after entering the period of extended operation, and every 10 years thereafter, while the leakage continued (Commitment No. 33). The applicant also discussed the recommended actions from the 2003 investigation and stated that several of the actions have not been completed because the applicant has been unable to stop the leakage. The applicant explained that it has tried several unsuccessful mitigation methods since 2003; however, it has plans in place to try new leak detection methods and hopes to have repaired the leak by 2016. If the repairs are unsuccessful, the applicant restated that it will continue taking core bores of the concrete every 10 years until the leakage is stopped. The applicant finally stated that the components exposed to borated water leakage were managed under the Boric Acid Corrosion Control Program. The program provides detailed requirements for conducting inspections and evaluating the results. The applicant stated that the specific components exposed to boric acid in this case were found to have negligible material loss and were evaluated and, until the next RFO, found acceptable as is.

The staff reviewed the applicant's response and was not clear how the applicant was demonstrating the structural integrity of the affected structures. A report in 2003 demonstrated the structural integrity; however, the leakage has continued during RFOs since that time, and it was not clear that any additional actions had been taken to reassess the structural integrity. In addition, it was not clear to the staff the volume of leakage that was detected during each outage. Therefore, the staff held a teleconference with the applicant on October 5, 2011, to discuss the adequacy of the timing of the concrete bores. In response to the discussion, the applicant supplemented its response by letter dated October 21, 2011. In its supplemental response, the applicant summarized the actions it has taken to date to address the leakage, which have included application of an epoxy coating to areas suspected of having leaks, staged fills of the refueling cavity in an attempt to locate the leaks, and plans to replace grafoil washers, which may be a source of leakage. The applicant also explained that the leakage has been minimal; on the order of approximately 0.2 gal. per minute. The applicant further explained that the minimal leakage, which only occurs during RFO, would have had at most a minor impact on the integrity of the affected structures. The applicant noted that industry operating experience exists with plants experiencing greater volumes of leakage (3 to 7 gal. per minute) with no identified degradation of the surrounding concrete.

The staff reviewed the applicant's response and the supplement and found it acceptable. The staff noted that the leakage only occurs during RFOs (approximately 1 month out of every 24 months) and the leakage is minimal (less than 300 gal. per day) during the outages. Therefore, the staff finds it reasonable to assume the integrity of the structures has not been significantly affected by the leakage since the integrity was confirmed in 2003. The staff also noted that the applicant has plans in place to verify the adequacy of the concrete with core bores prior to the period of extended operation and to continue to periodically evaluate the concrete with core bores if it is unable to stop the leakage. The results of the evaluations will be compared to acceptance criteria in ACI 349.3R, and any significant degradation will be entered into the Corrective Action Program. Finally, the staff noted that the applicant inspects the components exposed to boric acid every outage and verifies that the components will be able to perform their intended function until the next outage. The staff finds the applicant's response acceptable because:

- The applicant has plans in place to stop the leakage;
- The applicant committed (Commitment No. 33) to verify the adequacy of the affected concrete with core bores prior to the period of extended operation;
- The applicant committed (Commitment No. 33) to continue verifying the concrete's adequacy with core bores during the period of extended operation if it is unable to stop the leakage;
- The applicant has an acceptable visual inspection program in place to inspect accessible concrete at least every five years; and,
- The applicant has an acceptable inspection and evaluation program in place to address components exposed to boric acid.

The staff's concerns described in RAIs B.2.39-1 and B.2.39-9 are resolved.

A review of program basis documentation related to Program Element 10, "Operating Experience," noted that during Maintenance Rule Evaluation of Structures inspections, water had been noted to leak from the SFP and travel through the surrounding concrete. The leakage has been active periodically into the ECCS pump room 1. Indications of cracking and staining on the underside of the SFP and transfer pit (ceiling of room 109) were also observed during a plant walkdown. In 2001, investigation and evaluation of the periodic SFP leak indicated that 6 of the 21 leak chase channels were blocked. The leak chase channels were unclogged, releasing a significant amount of trapped fluid in several of the blocked leak chase channels. After unclogging, the leak collection isolation valves were cleaned. Since that time, leak detection activities have been performed monthly with intermittent small quantities of fluid having been captured from several leak chase channels. Recent results indicate that two of the leak chase drains are exhibiting continual small leakage. It is unclear to the staff that the concrete and steel reinforcement of the SFP have not been impacted by the borated water.

By letter dated April 5, 2011, the staff issued RAI B.2.39-2 requesting that the applicant do the following:

- provide historical data on the leakage occurrence and volume and available results from chemical analysis performed on the leakage
- provide the root cause analysis that was performed to identify the source of leakage, including information on the path of the leakage and structures that could potentially be affected by the presence of the borated water
- provide background information and data to demonstrate that concrete and embedded steel reinforcement potentially exposed to the borated water have not been degraded

- discuss any remedial actions or repairs that are planned to address concrete cracking such as observed on the underside of the SFP and when they will be implemented

In its response dated May 24, 2011, the applicant stated that, based on visual inspections of walls and floors adjacent to the SFP, the current leakage appears to be contained within the leak chase channels. In the response, the applicant also committed to take core bores prior to the period of extended operation from the two locations where leakage had been identified and to evaluate the cracking on the underside of the SFP (Commitment Nos. 37 and 38).

The staff reviewed the applicant's response and found it unacceptable. Although the applicant committed to taking core bores, the response did not provide details about when the cores would be taken or why the existing condition was acceptable until the cores are taken and the evaluation is conducted. The response did not address what would be included in the evaluation of the cores or the acceptance criteria that would be used in the evaluation. In addition, the applicant did not commit to keeping the leak chase channels clear during the period of extended operation. Therefore, by letter dated July 21, 2011, the staff issued followup RAI B.2.39-10 requesting the applicant to provide additional information about the SFP leakage including the following:

- how the leak chase channels will be kept functional
- when the cores will be taken and how they will be evaluated
- how the cracking on the underside of the SFP will be evaluated

In its response dated August 17, 2011, the applicant stated that leakage will be kept from migrating through the concrete walls of the SFP, the transfer pit, and the cask pit by allowing leakage to continuously drain through the leak chase piping and by keeping the leak chase piping and valves clear. The applicant stated that it currently monitors the inaccessible areas south of the auxiliary building wall as part of the implementation of the NEI groundwater protection initiative for Davis-Besse. The applicant also stated that, due to the configuration of the leak chase channels, the leak chase trenches, the leakage collector tubes, and the leak chase piping, it is not practical to verify by 100 percent visual inspection that the leak chase channels and trenches are clear. Therefore, a new reoccurring preventive maintenance activity to inspect and clean the zone drain piping and valves will be performed every 18 months, beginning prior to entering the period of extended operation (Commitment No. 30). The applicant stated that 18 months was an appropriate frequency based on operating experience and that the adequacy of the inspection frequency would be confirmed with annual visual inspections of the SFP floor and walls. The applicant also committed to conduct more frequent chemical analysis of SFP leakage. Collected leak chase drainage will be analyzed for pH monthly and for iron every 6 months (Commitment No. 30). The applicant further stated that it will perform core bores of the ECCS pump room No. 1 wall and room 109 ceiling. The applicant further stated (Commitment No. 37) that the first set of core bores will be performed by the end of 2014, and the second set of core bores will be performed by the end of 2020. The applicant stated that the core bores will expose reinforcing bar in the wall and ceiling to allow for visual inspection and collection of corrosion products for testing. In addition, the core bore samples will be examined for signs of corrosion or chemical effects of boric acid on the concrete or reinforcing bars, and will be subject to petrographic examination. The applicant also stated that degradation identified from the samples will be entered into the Corrective Action Program. The applicant further stated that the condition of the concrete and reinforcing steel will be evaluated to assist in determining what repairs, if any, need to be made to the underside of the SFP.

The staff reviewed the applicant's response and finds it acceptable because the applicant has committed to:

- maintain the leakage pathway valves open for those pathways having the most leakage;
- inspect and clean the zone drain piping and valves every 18 months beginning prior to entering the period of extended operation;
- visually inspect the accessible outside walls and floors of the pool and pits once a year for leakage migrating through the walls; and,
- take two sets of core bores from areas of historic leakage to verify that the past leakage did not cause any unexpected degradation to the concrete structures.

In addition, the applicant has committed to conduct more frequent chemical analysis of the SFP leakage to assure that the effluent is not contributing to concrete degradation and corrosion of steel leak chase members and rebar. If SFP leakage through another wall or ceiling is identified in the future, core bores will be taken at those locations. The visual inspection of the accessible concrete surfaces, along with examination of the core bore samples, provides the staff reasonable assurance that the condition of the concrete is being adequately evaluated, and the effects of boric acid on the concrete and rebar is being addressed. Therefore, the staff's concerns described in RAIs B.2.39-2 and B.2.39-10 are resolved.

During a field walkdown with the applicant's technical personnel on February 15, 2011, the staff noted indications of spall repairs in two areas located on the northwest side of the shield building near the upper right corner of the former RV head entry cut out. This observation led to discussions relative to inspection procedures and criteria that were used for the shield building. It is unclear to the staff how inspections are performed to identify degradation such as the noted repair locations (e.g., direct measurements, optical aids, scaling technology, and use of photography to document and help quantify degradation). It was also unclear how inspections of the shield building will be performed during the period of extended operation and how the inspections will be used to manage aging.

By letter dated April 5, 2011, the staff issued RAI B.2.39-7, asking the applicant to explain how aging management will be accomplished for the shield building during the period of extended operation.

By letter dated May 24, 2011, the applicant stated that the Structures Monitoring Program manages the shield building and will be enhanced to require optical aids, scaling technologies, mechanical lifts, ladders, or scaffolding to allow visual inspections that meet the guidelines of ACI 349.3R (Commitment No. 20).

The staff reviewed the applicant's response and found it unacceptable because, although the applicant committed to enhancing the Structures Monitoring Program prior to the period of extended operation, the response provided no information on the spalls on the shield building. Therefore, by letter dated July 21 2011, the staff issued followup RAI B.2.39-12, requesting that the applicant provide more information about the spalls on the shield building, including how they were identified and found acceptable or repaired.

In its response dated August 26, 2011, the applicant stated that three spalls had been identified on the outside surface of the shield building at an elevation about 30 ft above finish grade. The applicant stated that the spalls were first identified during a Maintenance Rule structural evaluation of the shield building in 1999. The spalls were also identified again by security and operations personnel during their normal activities and by a technical services employee as a result of a required external inspection of the shield building. The applicant also stated that the basis for accepting the spalls was documented in the 1999 and 2005 Maintenance Rule Evaluation Work Sheets, which noted that although some minor spalling was present, no areas would create a structural concern. The applicant stated that there is a maintenance order for pending repair of the shield building spalled concrete. The applicant further stated that Section 15 of Specification C-401Q, "Forming, Placing, Finishing, and Curing of Concrete," details the methods used to restore concrete. The method of repair is based on the actual size, depth, and amount of rebar exposed in the area to be repaired.

The staff reviewed the applicant's response and finds it acceptable because the applicant provided information as to how the spalls were identified and how they were evaluated and stated that there is a maintenance order for pending repair of the spalled concrete. In addition, the applicant has a plant procedure in place for restoring concrete. The staff's concern described in RAIs B.2.39-7 and B.2.39-12 is resolved.

In October 2011, during hydro-demolition of the concrete shield building in order to perform a scheduled reactor head replacement, cracks were identified in the containment shield building. While investigating the extent of the cracking, additional cracks were identified around the shield building. The additional cracks were identified using an impulse response technique, and core bores were used to verify the impulse response results. The identified cracks are hairline, laminar cracks near the exterior reinforcement matt. Additional information about the cracking, current operability of the plant, and ongoing staff actions can be found in the Confirmatory Action Letter issued by the staff on December 2, 2011, and in the inspection report issued on May 7, 2012. The staff continues to monitor this issue under the current license oversight process (Part 50); however, the degradation also impacts the shield building's ability to perform its intended function during the period of extended operation. Therefore, by letter dated December 27, 2011, the staff issued RAI B.2.39-13 requesting the applicant to provide information on how the cracking impacts the shield building's ability to perform its intended function during the period of extended operation and how the plant-specific operating experience will be incorporated into the Structures Monitoring AMP. By letter dated, April 5, 2012, the applicant responded. In the response the applicant stated that the root cause of the shield building laminar cracking was a lack of an exterior sealant on the shield building. To address this degradation the applicant plans to apply a protective coating to prevent moisture from penetrating the shield building wall, re-establish design and licensing basis conformance, and develop a testing program to determine the structural effect of the laminar cracks on adjacent steel reinforcement. The response further states that no new direct aging effects are associated with the shield building laminar cracks; however, a new plant-specific aging management program, the "Shield Building Monitoring Program," was submitted to monitor the shield building cracking and the condition of the sealant after it is chosen and applied. The submittal outlines a visual inspection program to monitor the condition of the concrete cracking and stated that inspection frequency and methods, testing methods, and acceptance criteria for monitoring the coating would be developed at a later date, after the coating was selected prior to the period of extended operation.

The staff reviewed the applicant's response and submittal and found it unacceptable based on the following:

The response states that a coating would be applied to the shield building to preclude future moisture intrusion; however, no discussion is provided about how the coating will be selected and shown to be capable of preventing moisture intrusion. Minimal information was provided regarding how the coating will actually be inspected and found acceptable during the period of extended operation.

The response explains that visual inspections will be conducted on the shield building cracking at existing core bore holes beginning in 2012 and continuing into the period of extended operation. The response further notes that the inspection interval will start at one year and gradually increase to five years, depending on the results of the inspections. However, the response does not provide adequate technical justification for the sample size of the core bore inspections, or for increasing the inspection interval to five years. The response fails to provide adequate detail about the qualifications of the inspectors and the acceptance criteria.

The root cause was tied to a blizzard that affected structures throughout the site; however, the response does not clearly explain why similar degradation did not occur in other structures throughout the site. In addition, the response provides an AMP to address aging of a new waterproof coating for the shield building, but does not discuss the necessity of a coating for other structures, or how existing coatings on other structures will be managed for aging during the period of extended operation.

To address the above concerns, by letter dated July 11, 2012, the staff issued RAIs B.2.43-1, B.2.43-2, and B.2.43-3 regarding the coating and associated inspections, the crack inspections, and the adequacy of the scope of the program, respectively. By letter dated August 16, 2012, the applicant responded to the staff RAIs. However, at the time of the issuance of the SER with OI (July 31, 2013) the issues associated with the RAIs were still unresolved and the staff identified them as OI 3.0.3.2.15-1. A summary of the staff's review of these RAIs and its respective closure of OI 3.0.3.2.15-1, as well as an element by element review of the plant-specific Shield Building Monitoring Program, can be found in Section 3.0.3.3.9 of this SER.

Based on its audit and review of the application, review of the applicant's response to RAIs B.2.39-1, B.2.39-2, B.2.39-7, B.2.39-9, B.2.39-10, and B.2.39-12 the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.50 and is, therefore, acceptable.

<u>USAR Supplement</u>. LRA Sections A.1.39 provides the USAR supplement for the Structures Monitoring Program.

In LRA Appendix A, "Updated Safety Analysis Report Supplement," the applicant provided the USAR supplement for the Structures Monitoring Program. The staff reviewed the USAR supplement sections and noted that they conform to the recommended description for these types of programs, as described in SRP-LR Table 3.5-2. The staff also noted that the applicant committed (Commitment No. 20) to enhance the Structures Monitoring Program prior to April 22, 2017.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its onsite audit and review of the applicant's Structures Monitoring Program the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent, based on the resolution of the RAIs as discussed above. Also, the staff reviewed the enhancements and confirmed that their

implementation through Commitment No. 20, prior to the period of extended operation, would make the existing AMP consistent with GALL Report AMP XI.S6 to which it was compared. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR 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 Water Control Structures Inspection

Summary of Technical Information in the Application. LRA Section B.2.40 describes the existing Water Control Structures Inspection Program as consistent, with exceptions and enhancements, with GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." The applicant stated that Davis-Besse is not committed to RG 1.127; however, enhancements pertaining to the inspection guidance in RG 1.127 will be implemented consistent with the GALL Report recommendations. The applicant also stated that the program is implemented as part of the Structures Monitoring Program, and it monitors age-related degradation of the intake structure, forebay, service water discharge structure, and structural components within the structures.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL Report AMP XI.S7. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL Report AMP XI.S7, with the exception of the "detection of aging effects," and "acceptance criteria" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

While reviewing the "detection of aging effects" program element, the staff noted that the chemical parameters for the applicant's groundwater are considered to be aggressive per the GALL Report guidelines (i.e., chlorides = 2,870 ppm (max) and sulfates = 1,700 ppm (max)). LRA Section B.2.39 states that the Structures Monitoring Program will be enhanced to require the responsible engineer to review the raw water chemistry for unusual trends during the period of extended operation, raw water chemistry will be collected at least once every 5 years with data collection staggered to account for seasonal variations, and monitoring of below-grade inaccessible concrete components will be implemented before the period of extended operation. However, it is unclear to the staff that inaccessible concrete components, including portions of water-control structures exposed to groundwater, have not been adversely impacted by the aggressive groundwater. It is also unclear to the staff when an examination of an inaccessible concrete component will be conducted. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.39-3, asking the applicant to do the following:

- provide background information and data to demonstrate that the concrete and steel reinforcement subjected to aggressive groundwater is not degrading
- explain how the applicant will address aggressive groundwater infiltration to ensure that resulting aging effects, especially in inaccessible areas, will be effectively managed during the period of extended operation

In its response dated May 24, 2011, the applicant stated that there is no evidence that the aggressive groundwater at Davis-Besse has contributed to structural degradation. However, the applicant revised Commitment No. 20 to include a concrete core bore from a representative inaccessible structure subjected to aggressive groundwater prior to entering the period of extended operation. The applicant also revised Commitment No. 20 to state that depending on the results of the initial core bore, the need for additional samples and additional normally inaccessible locations will be evaluated.

The staff reviewed the applicant's response and found it unacceptable. Although the applicant committed to taking core bores, the response did not provide details about when the cores would be taken, where they would be taken, what would be included in the evaluation of the cores, or the acceptance criteria that would be used to determine adequacy of affected concrete. Therefore, by letter dated July 21, 2011, the staff issued followup RAI B.2.39-11 asking the applicant to provide additional information about the concrete cores, including the timing, location, and tests to be completed on the cores.

In its response dated August 26, 2011, the applicant stated that it plans to investigate the effect of site groundwater on reinforced concrete structures using invasive testing and visual inspection. The applicant stated that it plans to take two core bores prior to entering the period of extended operation: one from the inside of the east wall of the turbine building condenser pit at approximately 573-ft elevation and one from the auxiliary building ECCS pump room No. 1 floor at approximately 545-ft elevation. In addition, the applicant plans to expose reinforcing steel at these locations to inspect for corrosion; collect samples; measure wastage and corrosion buildup; and evaluate cracking. The applicant further stated that it plans to subject the core bore samples to petrographic examination to determine chemical effects on the concrete and conduct compressive strength tests for comparison with the original concrete design strength. ACI 349.3R-02 will be used as a reference for acceptance criteria for specific inspection and testing results. The applicant committed to these actions and revised Commitment No. 20 accordingly.

The staff reviewed the applicant's response and could not determine why the applicant was waiting until the period of extended operation (2017) to take the core bores when the groundwater infiltration is a current chronic problem. Therefore, the staff held a teleconference with the applicant on September 13, 2011, to discuss the adequacy of the timing of the concrete bores. In response to the discussion, the applicant supplemented its response by letter dated October 7, 2011. In its supplemental response the applicant revised Commitment No. 20 and added a new commitment (Commitment No. 26) to complete the core bores by the end of 2014.

The staff reviewed the applicant's response, and the associated supplement, and finds it acceptable because the applicant committed to taking two core bores by the end of 2014 at locations known to have had extended groundwater infiltration. In addition, the applicant plans to subject the core bore samples to petrographic examination to determine the chemical effects on concrete. If degradation is detected, the applicant will enter it into the Corrective Action Program, and if no degradation is detected, the core bores provide assurance that concrete exposed to groundwater leakage will continue to perform its intended function during the period of extended operation. Finally, the applicant will use ACI 349.3R-02 as a reference for acceptance criteria in determining the adequacy of the affected concrete, which is consistent with recommendations in the GALL Report and, therefore, acceptable. The staff finds that the timing of the cores is acceptable because there have been no visual indications of significant degradation to date and the cores will be completed prior to the period of extended operation. The staff's concerns described in RAIs B.2.39-3 and B.2.39-11 are resolved.

While reviewing the "preventive action" program element, the staff noted that the LRA did not discuss the use of ASTM A325, ASTM F1852, or ASTM A490 bolts and the associated preventive actions recommended in "Specification for Structural Joints Using ASTM A325 or A490 Bolts." A recent staff review determined that if ASTM A325, ASTM F1852, or ASTM A490 bolts are used, the preventive actions discussed in Section 2 of the RCSC, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," should be followed. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.39-8, asking the applicant to explain how the preventive actions discussed in Section 2 of the RCSC are addressed if ASTM A325, ASTM F1852, or ASTM A490 bolts are used within the scope of license renewal.

In its response dated May 24, 2011, the applicant stated that ASTM A325 and ASTM A490 bolts are used at Davis-Besse. The applicant also stated that the current edition of the specification used onsite does not include the preventive actions discussed in Section 2 of the recommended RCSC standard. Therefore, the applicant added a new commitment (Commitment No. 31) to incorporate the preventive actions of the RCSC specification into the site specifications and implementing procedures that address structural bolting within the scope of license renewal.

The staff reviewed the response and finds it acceptable because the applicant committed to incorporate the appropriate preventive actions into the implementing procedures for structural bolting. This will make the applicant's "preventive actions" program element consistent with the guidance in the corresponding element of the GALL Report and, therefore, acceptable. The staff's concern described in RAI B.2.39-8 is resolved.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with exceptions and enhancements to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements follows.

Exception 1. LRA Section B.2.40 states an exception to the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements. For these program elements, GALL Report AMP XI.S7 recommends inspecting dams, spillway structures, reservoirs, and safety and performance instrumentation for applicable aging effects. Alternatively, the LRA states that the associated program structural components are not installed at Davis-Besse; therefore, the associated portions of the GALL Report program are not applicable.

The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because it does not have the particular structural components elements within the scope of license renewal. The staff reviewed the LRA and the USAR and confirmed that the applicant does not have any dams, spillway structures, reservoirs, or safety and performance instrumentation within the scope of license renewal. Therefore, the staff finds the applicant's exception to the related guidance acceptable since none of the components is within the scope of license renewal.

Exception 2. LRA Section B.2.40 states an exception to the "acceptance criteria" program element. In GALL Report AMP XI.S7, this program element recommends that acceptance criteria for earthen structures are consistent with programs that are within the jurisdiction of the Federal Energy Regulatory Commission (FERC) or U.S. Army Corps of Engineers (USACE) programs. Alternatively, this program element in the LRA states that the earthen structures at Davis-Besse are not within the jurisdiction of FERC or the USACE; therefore, the associated portions of GALL Report AMP XI.S7 are not applicable.

The staff reviewed this exception to the GALL Report and noted that although the applicant does not have earthen structures that are within the jurisdiction of FERC or USACE, the applicant does have earthen structures within the scope of license renewal. The applicant's acceptance criteria for the earthen structures within the scope of license renewal should be consistent with the criteria of FERC or USACE programs. Since the applicant has earthen structures within the scope of license renewal, the staff does not agree that this exception is appropriate; however, the staff reviewed the program acceptance criteria for earthen embankments during the safety audit and confirmed that the applicant's acceptance criteria are consistent with criteria in FERC or USACE programs. Both the applicant's program guidance and FERC or USACE criteria advise the inspectors to examine earthen structures for signs of settlement, slope stability, seepage, etc. Although the staff does not agree this exception is appropriate, the staff finds the applicant's Water Control Structures Inspection Program "acceptance criteria" program element acceptable because it includes the appropriate GALL Report recommended criteria for earthen structures, regardless of the applicant's exception.

Enhancement 1. LRA Section B.2.40 states an enhancement to the "scope of program" program element. This enhancement expands on the existing program element by adding the service water discharge structure to the scope of the program.

The staff finds this enhancement acceptable because, when implemented, the Water Control Structures Inspection Program will address the water control structures included within the scope of license renewal. This enhancement will make the "scope of program" program element of the applicant's Water Control Structures Inspection Program more consistent with the "scope of program" program element recommendations provided in GALL Report AMP XI.S7.

Enhancement 2. LRA Section B.2.40 states an enhancement to the "parameters monitored or inspected" program element. This enhancement expands on the existing program element by adding parameters monitored to the program in accordance with guidance provided in Section C.2 of RG 1.127 and ACI 201, "Guide for Making a Condition Survey of Concrete in Service."

The staff finds this enhancement acceptable because, when implemented, this enhancement will add clarification to the guidance used for selection of parameters monitored or inspected. This enhancement will make the "parameters monitored or inspected" program element of the applicant's Water Control Structures Inspection Program more consistent with industry standards and the "parameters monitored or inspected" program element recommendations provided in GALL Report AMP XI.S7.

Enhancement 3. LRA Section B.2.40 states an enhancement to the "detection of aging effects" program element. This enhancement expands on the existing program element by adding requirements that water control structure periodic inspections are performed at least once every 5 years.

The staff finds this enhancement acceptable because, when implemented, the enhancement will align the applicant's inspection frequency with the guidance in RG 1.127 and GALL Report AMP XI.S7, which recommend inspections be performed at least once every 5 years.

Enhancement 4. LRA Section B.2.40 states an enhancement to the "monitoring and trending" program element. This enhancement expands on the existing program element by adding requirements to ensure compliance with the documentation requirements of 10 CFR 54.37, including submittal of records and structural evaluations to records management.

The staff finds this enhancement acceptable because, once implemented, the Water Control Structures Inspection Program will meet the requirements of 10 CFR 54.37 for program documentation and record-keeping related to license renewal.

Enhancement 5. LRA Section B.2.40 states an enhancement to the “acceptance criteria” program element. This enhancement expands on the existing program element by adding ACI 349.3R-96, “Evaluation of Existing Nuclear Safety-Related Concrete Structures,” as a reference that will be considered when developing acceptance criteria for water control structures.

The staff reviewed this enhancement and noted that it states that ACI 349.3R-96, “Evaluation of Existing Nuclear Safety-Related Concrete Structures,” will be listed as a reference and considered in developing inspection acceptance criteria. GALL Report AMP XI.S7 states that plant-specific acceptance criteria based on ACI 349.3R-96 are acceptable. It is not clear to the staff that these statements are consistent because the applicant will only use the recommended document as a reference when developing the program acceptance criteria. If the applicant’s acceptance criteria will deviate from the recommended criteria, adequate technical justification should be provided. In addition, while reviewing the “acceptance criteria” program element during the audit, the staff noted that the applicant’s inspection criteria used to assess the condition of structures and structural components are found in a Maintenance Rule evaluation procedure for the Maintenance Rule Evaluation of Structures. Evaluation criteria follows guidance contained in NEI 96-03 “Guideline for Monitoring the Condition of Structures at Nuclear Power Plants.” Plant basis documentation identifies acceptance criteria as Y (structure/area/room acceptable, no design basis violation, housekeeping may or may not be required), W (structure/area/room acceptable with deficiencies), and N (structure/area/room unacceptable). Very few quantitative inspection criteria are provided in the basis documents or plant procedures and at least one example of acceptance criteria reviewed does not meet ACI 349.3R requirements (i.e., crack widths less than 0.0625 in. as acceptable whereas ACI lists crack widths less than 0.015 in. as acceptable). It is unclear to the staff what quantitative acceptance criteria are used and whether the acceptance criteria used align with guidance such as ACI 349.3R, as recommended by the GALL Report. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.39-6, asking the applicant to do the following:

- provide the quantitative acceptance criteria for the Water-Control Structures Inspection Program. If the concrete acceptance criteria deviate from those discussed in ACI 349.3R, provide technical justification for the differences
- if quantitative acceptance criteria will be added to the programs as an enhancement, provide plans and a schedule to conduct a baseline inspection with the quantitative acceptance criteria prior to the period of extended operation

In its response dated May 24, 2011, the applicant revised the LRA to include an enhancement and commitment (Commitment No. 20) to include quantitative acceptance criteria based on the guidance in ACI 349.3R. The applicant also committed (Commitment No. 21) to conduct a baseline inspection of the structures within the scope of license renewal, using the quantitative acceptance criteria, prior to entering the period of extended operation.

The staff reviewed the response and finds it acceptable because the applicant committed to develop quantitative acceptance criteria based on ACI 349.3R and to conduct a baseline inspection prior to the period of extended operation. These commitments will make the applicant’s “acceptance criteria” program element consistent with the guidance in the corresponding element of the GALL Report and, therefore, acceptable. The staff's concern in RAI B.2.39-6 is resolved.

Based on the staff's review, and the applicant's response to RAI B.2.39-6, the staff finds the applicant's enhancement to the "acceptance criteria" program element acceptable because it will make the applicant's program element consistent with the corresponding element in the GALL Report.

Based on its audit, review of the applicant's responses to RAIs B.2.39-3, B.2.39-6, B.2.39-8, and B.2.39-11 the staff finds that elements one through six of the applicant's Water Control Structures Inspection Program, with acceptable exceptions and enhancements, are consistent with the corresponding program elements of GALL Report AMP XI.S7 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.40 summarizes operating experience related to the Water Control Structures Inspection Program. The applicant stated that, during an inspection in 2007, the north side of the embankment in the intake canal was found to have settled. A slope stability study found the degradation occurred as a result of the presence of low compressive strength clay. The applicant further stated that a subsequent diver inspection revealed that the toe of the embankment had not moved. The applicant stated that a preventive maintenance was established to measure the slope, width, elevation, and length of the intake canal every 3 years. The applicant further stated that this preventive maintenance was established to ensure the degradation would continue to be monitored and any future degradation would be captured. The applicant also stated that minor degradation, such as surface rust on steel sheet piling, vegetation on earthen dikes, and holes from burrowing animals, has been found and appropriately addressed. The applicant concluded that, with the exception of the settlement issue, the water control structures are in good working condition and the Corrective Action Program will continue to effectively manage aging during the period of extended operation.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the audit report, the staff conducted an independent search of the plant operating experience information to determine if the applicant adequately incorporated and evaluated operating experience related to this program. During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff noted that the applicant identified degradation of the intake canal embankment due to settlement, and the applicant established a preventive maintenance to measure the slope, width, elevation, and length of the canal on a 3-year basis. However, the staff could not determine corrective actions in place are adequate to address the possible aging effects and ensure the structural stability of the embankment during the period of extended operation. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.40-1 requesting the applicant explain how the integrity of the embankment is being ensured and how related aging effects will be addressed during the period of extended operation.

In its response dated May 24, 2011, the applicant stated that, in 2007, a slope stability study was conducted by an independent geotechnical engineering firm. The study concluded that the affected area was localized to the areas identified and that the condition was insignificant to the original design of the canal. The applicant also stated that a preventive maintenance activity has been initiated to monitor the embankment, including inspection and measurement of the embankment below and above the water surface. The applicant further stated that further evaluation of the embankment, including additional core bores in 2011, will be completed to better understand the failure mechanism and to evaluate repair options.

The staff reviewed the applicant's response and found it unacceptable. Although the applicant stated long-term evaluation plans had been developed, they did not provide details about the plans, nor did they commit to completing the investigation and possible repairs prior to the period of extended operation. Therefore, by letter dated July 21, 2011, the staff issued followup RAI B.2.40-2 asking the applicant to provide additional information about the intake canal embankment investigation and repairs and to commit to completing the investigation and necessary repairs prior to the period of extended operation.

In its response dated August 17, 2011, the applicant committed (Commitment No. 48) to complete the investigation and evaluate the results and complete needed repairs prior to the period of extended operation. The staff reviewed the applicant's response and found it unacceptable because the applicant provided no details about the investigation. Therefore, by letter dated October 11, 2011, the staff issued RAI B.2.40-3 requesting the applicant provide details about the embankment investigation, including scheduling information; repair activities planned and completed to date; and probable corrective actions.

In its response dated October 31, 2011, the applicant summarized the activities completed to date, which included a detailed survey and underwater inspection of the forebay and intake canal dikes, including the portion that serves as the ultimate heat sink and the degraded portion. The applicant stated that the data from the inspections were reviewed by a geotechnical engineering consultant, who found that the as-found condition of the canal is less conservative than the as-analyzed condition. To address this, the applicant conducted a prompt operability determination for the degraded condition, which demonstrated there was sufficient conservatism in the canal design to ensure the ultimate heat sink could continue to perform its design functions. The applicant further stated that corrective actions associated with the prompt operability determination may include calculation alterations to address the discrepancies between the as-found and as-analyzed conditions or repairs to the ultimate heat sink. The applicant also performed four core bores into the degraded area of the dike and installed slope stability monitoring devices in the degraded area of the dike to verify long-term stability.

In its response, the applicant also summarized planned activities and anticipated completion dates. The applicant stated that the geotechnical engineering consultant was expected to submit a report detailing the results of the canal studies, including the results of the core bores and the slope stability monitors, as well as recommended remedial actions, by May 30, 2012. A third party review of the geotechnical report and proposed remedial actions is planned to be completed by July 30, 2012. The applicant further stated that the engineering change package for the remediation of the dike is planned to be issued by November 31, 2012, and the work is expected to be completed by December 30, 2014. The applicant also stated that the probable remediation method would likely include excavation of the affected areas, replacement of material with designed fill material, and completion of engineering documentation supporting the acceptability of the resulting factor of safety. Finally, the applicant stated that the proposed repair schedule was acceptable because the prompt operability determination calculations showed that the reduction in ultimate heat sink surface area and volume are acceptable and that the intake canal dikes remain capable of performing their design function during a seismic event in their current as-found condition. In addition, the applicant stated that prior to the period of extended operation is an acceptable deadline for license renewal because completing the remediation work by that deadline ensures that the condition of the dike will be aligned with the CLB.

The staff reviewed the applicant's response and finds it acceptable because:

- The applicant has completed an operability determination demonstrating the canal is capable of performing its design function in the current as-found condition.
- The applicant has plans in place to monitor the condition of the slope, including detailed surveys and underwater inspections.
- The applicant has committed to complete repairs of the canal embankments prior to the period of extended operation.

These repairs will return the embankment to a condition that will allow it to fulfill its original design function and will align the embankment with the analyzed condition in the CLB prior to the period of extended operation. The embankment degradation is also a concern under the current license, and is being actively monitored by the staff through the current license oversight process (Part 50). The staff's concern in RAI B.2.40-1, and followup RAIs B.2.40-2 and B.2.40-3, is resolved.

Based on its audit and review of the application, and RAIs B.2.40-1 and followup RAIs B.2.40-2 and B.2.40-3, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.40 provides the USAR supplement for the Water Control Structures Inspection Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.5-2.

The staff also notes that the applicant committed (Commitment No. 21) to enhance the Water Control Structures Inspection Program prior to entering the period of extended operation.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Water Control Structures Inspection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 21, prior to the period of extended operation, would make the existing AMP consistent with GALL Report AMP XI.S7 to which it was compared. The staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent With or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Air Quality Monitoring Program
- Boral® Monitoring Program
- Collection, Drainage, and Treatment Components Inspection Program
- Leak Chase Monitoring Program
- Nickel-Alloy Management Program
- PWR Reactor Vessel Internals Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program
- Nuclear Safety-Related Protective Coatings Program
- Shield Building Monitoring Program

For the AMPs not consistent with or not addressed by the GALL Report, the staff performed a complete review of the plant-specific AMP to determine if it was adequate to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections of this SER.

3.0.3.3.1 Air Quality Monitoring Program

<u>Summary of Technical Information in the Application</u>. LRA Section B.2.3 describes the existing Air Quality Monitoring Program as plant-specific. The applicant stated that the purpose of the Air Quality Monitoring Program is to ensure that the instrument air system remains dry and free of contaminants to ensure that there are no AERMs. The applicant further stated that the program is based on existing commitments to NRC GL 88-14 and comprises periodic air quality sampling from the instrument air system. The applicant also stated that the Air Quality Monitoring Program is a preventive program.

<u>Staff Evaluation</u>. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

<u>Scope of Program</u>. LRA Section B.2.3 states that this program includes periodic sampling of the air quality in the instrument air system piping and piping components to ensure that the compressed air environment remains dry and free of contaminants, thereby ensuring that there are no AERMs for this system. The applicant also stated that the Air Quality Monitoring Program includes periodic sampling of system air quality, consistent with GL 88-14, and corresponding actions, if unacceptable moisture or contaminants are detected.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the specific program necessary for license renewal should be identified. The scope of the program should include the specific SCs of which the program manages the effects of aging.

The staff confirms that the applicant identified the system and components for which this program manages aging. However, a review of LRA Table 3.3.2-17, "Aging Management Review Results-Instrument Air System," indicates that the applicant identified no aging effects and no aging management required for steel and copper-alloy piping, tubing, and valves in an internal environment of dried air. The applicant cited plant-specific footnote 318, which states that the Air Quality Monitoring Program ensures that the instrument air system remains dry and free of contaminants, thereby sustaining the AMR conclusion that there are no aging effects that require management. SRP-LR Section A.1.2.1 states that an aging effect should be identified as applicable for license renewal even if there is a prevention or mitigation program associated with that aging effect.

By letter dated May 2, 2011, the staff issued RAI B.2.3-1 asking the applicant to justify why the LRA does not identify an aging effect as applicable for license renewal and credit the Air Quality Monitoring Program as a preventive program that manages this aging effect. In its response dated June 3, 2011, the applicant stated that the purpose of the Air Quality Monitoring Program, as described in its response to GL 88-14, is to ensure that the instrument air remains dry and free of contaminants (including oil and moisture) so that safety-related systems and components served by the instrument air system will not fail to perform their intended safety functions. The applicant further explained that for purposes of AMR, the environment of the instrument air system is evaluated as "dried air," whose quality is assured by the preventive actions of the Air Quality Monitoring Program. The applicant concluded that its approach is consistent with the GALL Report, which includes "air, dry" as an environment, which is air that has been treated to reduce its dew point well below the system operating temperature.

The staff reviewed the applicant's response and the GALL Report and finds the applicant's response acceptable because the Air Quality Monitoring Program ensures that dew point of the instrument air is maintained below the system operating temperature through periodic sampling and appropriate corrective actions. Additionally, the applicant is consistent with the GALL Report (i.e., there are no aging effects or mechanisms requiring management and no AMP is required for a dried air environment). The staff's concern described in RAI B.2.3-1 is resolved.

Based on its review of the application and the applicant's response to RAI B.2.3-1, the staff confirmed that the "scope of program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.3 states that the Air Quality Monitoring Program includes periodic sampling of the air quality of components in the instrument air system to ensure that the air remains dry and free of contaminants.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that the activities for prevention programs should be described. The SRP-LR also states that these actions should mitigate or prevent aging degradation.

The staff concluded that the applicant identified that periodic sampling of air quality will be performed. Based on its review of the application, the staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.3 states that the program periodically samples the compressed air within components of the instrument air system for hydrocarbons, dew point, and particulates to verify proper air quality and ensure that the intended function of the system is maintained.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states, in part, that the parameters monitored or inspected should be identified and linked to the degradation of the particular SC intended functions. SRP-LR Section A.1.2.3.3 further states that, for prevention and mitigation programs, the parameters monitored should be the specific parameters being controlled to achieve prevention or mitigation of aging effects.

The staff reviewed LRA Section B.2.3 and noted that the applicant identified hydrocarbons, moisture, and particulates as parameters that will be monitored to verify proper air quality. Based on its review of the application, the staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.3 states that the Air Quality Monitoring Program does not directly inspect for or detect the effects of aging in the instrument air system. The applicant further stated that, as described for the preventive actions element above, the presence of an environmental stressor (moisture), which could lead to corrosion of system components, is detected and moisture, if any, is removed to ensure air quality (and intended function) is maintained.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the SC intended function(s) will be adequately maintained for license renewal under all CLB design conditions. The SRP-LR also states that this program element describes, "when," "where," and "how" program data are collected. The SRP-LR also states that the method or technique and frequency may be linked to plant-specific or industry-wide operating experience, and to provide justification, including codes and standards referenced, that the frequency is adequate.

The staff reviewed LRA Section B.2.3 and noted that the applicant has not identified the frequency of periodic sampling nor provided any industry standards such as Instrument Society of America (ISA) or EPRI to confirm that frequency is adequate. By letter dated May 2, 2011, the staff issued RAI B.2.3-2 requesting the applicant to provide the frequency of periodic testing of contaminants and any industry standards used to determine the frequency. In its response dated June 3, 2011, the applicant stated that periodic testing of contaminants by the Air Quality Monitoring Program is performed each year and that the frequency of testing is based on the recommendations of Institute of Nuclear Power Operations (INPO) Supplemental Operating Experience Report (SOER) 88-1, "Instrument Air System Failures."

The staff reviewed the applicant's response and determined that it was not clear how periodic testing once a year ensures that the dew point is maintained well below the system operating temperature during normal operation. The staff noted that GALL Report AMP, XI.M24, "Compressed Air Monitoring," recommends in-line dew point instrumentation that either checks continuously using an automatic alarm system or is checked at least daily to ensure that moisture content is within specification. Furthermore, GALL Report AMP XI.M24 also recommends that periodic sampling and testing be performed in accordance with industry standards such as ISA-S7.0.01-1996, which state that continuous dew point monitoring provides early detection or warning or both to help prevent high moisture content. By letter dated July 27, 2011, the staff issued a followup RAI B.2.3-5 requesting that the applicant justify how periodic testing once a year ensures that the dew point is maintained well below the system operating temperature during normal operation such that the environment remains "dry-air."

In its response dated August 17, 2011, the applicant stated that instrument air is designed to have a dew point of 18 °F below the minimum local ambient temperature at 100 psig. The applicant further stated that, in response to GL 88-14, Davis-Besse committed to maintaining the instrument air system with a dew point of at least negative 35 °F. The applicant also stated that a control room annunciator exists for instrument air dryer trouble, with one of the actuating devices being high moisture content in the desiccant. The applicant further stated that periodic testing of contaminants is performed each year and monthly dew point readings are taken downstream of each of the air dryers.

The staff reviewed USAR Section 9.3.1.1, which states that "the instrument air dryers are capable of delivering dry air with a moisture content corresponding to a dew point of not more than [negative] 40 °F at 100 psig." Also, in its response to GL 88-14, the applicant stated the dew point of the instrument air system will be maintained at least at negative 35 °F. Maintaining the dew point well below the system operating temperature will help ensure that no condensation accumulates in the system. As indicated in the response to the RAI B.2.3-5, the control room operators are notified of high moisture content in the desiccant, thereby alerting them to the need for action. Lastly, monthly dew point testing of the air downstream of the dryers confirms that the air supplied to the instrument air system remains dry. For these reasons, the staff finds the applicant's response to RAIs B.2.3-2 and B.2.3-5 acceptable. The staff's concerns described in RAIs B.2.3-2 and B.2.3-5 are resolved.

Based on its review of the application and of the applicant's responses to RAI B.2.3-2 and B.2.3-5, the staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.3 states that air quality sampling of the instrument air system is performed periodically with a frequency dependent on the results of previous testing, and the results are sent to the plant or system engineer and are available for trending analysis as necessary.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states, in part, that there should be a description of the monitoring and trending activities, the parameter or indicator trended, and the methodology for analyzing the inspection or test results against the acceptance criteria.

Based on its review of the application, the staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.3 states that acceptance criteria for compressed air are specified for particulates (less than 2.0 milligrams per cubic meter for less than 3 micron particles), hydrocarbons (less than 1.0 ppm), and dew point (1 of 3 readings must be less than or equal to negative 37 °F dew point atmospheric) (as necessary) for sampling of the instrument air system. LRA Section B.2.3 also states that if specified acceptance criteria are not met, then the failure is entered into the Corrective Action Program, which drives corrective actions to meet the acceptance criteria.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. SRP-LR Section A.1.2.3.6 states that the acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation. SRP-LR Section A.1.2.3.6 also states that the program should include a methodology for analyzing the results against applicable acceptance criteria.

The staff reviewed LRA Section B.2.3 and noted that the applicant has not identified the basis for the acceptance criteria. By letter dated May 2, 2011, the staff issued RAI B.2.3-3 asking the applicant to provide the basis, such as CLB or industry standard, for the acceptance criteria.

In its response dated June 3, 2011, the applicant stated that the acceptance criteria for the Air Quality Monitoring Program are based on standard industry practices, as recommended by ANSI/ISA-S7.3-1975, "Quality Standard for Instrument Air." The applicant further stated that Davis-Besse meets these standards. The staff noted that ANSI/ISA-S7.3-1975 was superseded by ISA-S.7.0.01-1996. The staff reviewed ISA-S.7.0.01-1996 and noted that the applicant meets the acceptance criteria as defined in the ISA standard. The staff's concern described in RAI B.2.3-3 is resolved.

Based on its review of the application, and review of the applicant's response to RAI B.2.3-3, the staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.3 states that, as described in the Davis-Besse responses to GL 88-14, and confirmed by subsequent site operating experience, air quality monitoring continues to show that the instrument air is dry and contaminant free. The applicant further stated that there have been no failures or significant degradation of components in the instrument air system and that industry operating experience is also considered in the program. The applicant also stated that review of Davis-Besse operating experience did not reveal a loss of component intended function for components exposed to instrument air that could be attributed to an inadequacy of the Air Quality Monitoring Program, and abnormal air system conditions are promptly identified, evaluated, and corrected. The applicant stated that as an example, in 2007, one out of nine air samples drawn for particulate testing exceeded the preventive maintenance limit that was established as a threshold for further investigation. The applicant used the work order system to investigate and characterize the system piping that produced the high particulate loading.

The staff reviewed the applicant's "operating experience" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that operating experience with existing programs should be discussed. The operating experience of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered.

During its review, the staff determined the need for additional clarification, which resulted in the issuance of an RAI. Since the applicant did not describe in detail the cause of the abnormal particulate testing and corrective actions taken, the staff issued RAI B.2.3-4 by letter dated May 2, 2011, requesting additional details on the cause of the variance and associated corrective actions. In its response dated June 3, 2011, the applicant stated that for the 2007 air sample that exceeded the preventive maintenance limit, there were no corrective actions taken that resulted in program enhancements. The applicant further stated that the preventive maintenance limit was established as a threshold for further investigation, and the single out-of-specification reading from 2007 was considered to be a long-term reliability issue because critical and non-critical air-operated valves are provided with "point of use" air filter-regulators. Since 2007, air samples have not exceeded the preventive maintenance limit based on yearly air sampling.

The staff reviewed the applicant response and noted that the applicant uses a preventive maintenance limit to establish long-term reliability threshold for further investigation and that no corrective actions were taken. The staff noted that this was a one-time occurrence and that further yearly air sampling did not identify any other limits that were exceeded. The staff finds the applicant response acceptable because the applicant has a maintenance threshold limit established for further investigation, and further air sample tests were found to be acceptable. The staff's concern described in RAI B.2.3-4 is resolved.

Based on its review of the application, and review of the applicant's response to RAI B.2.3-4, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

<u>USAR Supplement</u>. LRA Section A.1.3 provides the USAR supplement for the Air Quality Monitoring Program. The staff reviewed this section and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.3-2. The staff determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its technical review of the applicant's Air Quality Monitoring Program, including the applicant's responses to the RAIs, the staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 Boral® Monitoring Program

<u>Summary of Technical Information in the Application</u>. LRA Section B.2.5 describes the new Boral® Monitoring Program as plant-specific. The applicant stated that the program will provide reasonable assurance that aging effects will be adequately detected such that the neutron absorber intended functions will be maintained for the period of extended operation. The applicant further stated that the program detects degradation of the Boral® neutron absorbers in the spent fuel storage racks with in-situ testing. The applicant further stated that adverse conditions will be documented in the Corrective Action Program.

<u>Staff Evaluation</u>. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program detects and manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of the elements follows.

<u>*Scope of Program*</u>. LRA Section B.2.5 states that this program consists of in-situ testing of the Boral® material in the spent fuel storage racks at Davis-Besse. The applicant also stated that the program is credited for detecting loss of material aging effects of the Boral® neutron absorbers.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific structures and components of which the program manages aging.

The staff does not find the applicant's "scope of program" program element to be adequate because the staff lacks sufficient information regarding the properties and configuration of the

Boral® panels. By letter dated April 5, 2011, the staff issued RAI B.2.5-1 (Q 1-4) requesting that the applicant further describe the material specifications, age, and manufacturer of the Boral® panels.

In its response dated May 5, 2011, the applicant stated that the storage cells are composed of stainless steel walls with a single fixed neutron absorber panel, Boral®, centered on each side in a 0.110 in. channel. The applicant also stated that the Boral® absorber has a thickness of 0.101 + 0.006 in. and a nominal B-10 areal density of 0.0324 g/cm^2. The applicant further stated that the panels were manufactured by AAR Manufacturing in 1998. In addition, the applicant stated that the sheathing that holds the Boral® panels in the racks is vented.

The staff finds the applicant's response acceptable because the additional specifications provided for the spent fuel storage cells clearly describes the structures and components managed by the Boral® Monitoring Program. The staff's concern described in RAI B.2.5-1 (Q 1-4) is resolved.

Based on its review of the application and review of the applicant's response to RAI B.2.5-1 (Q 1-4), the staff confirmed that the "scope of program" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.5 states that the applicant's Boral® Monitoring Program is a condition monitoring program; therefore, no actions are taken to prevent aging effects or mitigate age-related degradation.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that for condition or performance monitoring programs, the applicant does not rely on preventive actions and, thus, this information need not be provided. The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable

Parameters Monitored or Inspected. LRA Section B.2.5 states that the program monitors changes that can lead to loss of material or change of physical form of the Boral® neutron absorbers. The applicant also stated that the program monitors changes in physical properties of the Boral® by in-situ testing.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s).

The staff does not find the applicant's "parameters monitored or inspected" program element to be adequate because the staff lacks sufficient information regarding how the neutron absorption capacity of the material will be monitored. By letter dated April 5, 2011, the staff issued RAI B.2.5-1 (Q 3) requesting that the applicant include a description of the test methods, parameters measured, calculations, and acceptance criteria.

In its response dated May 5, 2011, the applicant stated that in-situ neutron attenuation testing will be performed to monitor B-10 areal density. The applicant also stated that the acceptance criteria will be 0.0300 g/cm^2 to meet the assumptions used in the SFP criticality analysis

The staff finds the applicant's response acceptable because in-situ neutron attenuation testing of the Boral® storage racks is an acceptable means to monitor for reduction in neutron absorber capacity. Also, monitoring the B-10 areal density of the Boral® storage racks makes this element of the program consistent with GALL Report AMP XI.M40 “Monitoring of Neutron-Absorbing Materials Other than Boraflex.” The staff’s concern described in RAI B.2.5-1 (Q 3) is resolved.

Based on its review of the application and review of the applicant’s response to RAI B.2.5-1 (Q 3), the staff confirmed that the “parameters monitored or inspected” program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3 and, therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.5 states that the program monitors the condition of the absorber material with in-situ testing. The applicant also stated that visual inspection and measurements are used to assess the extent of degradation in the Boral® before there is a loss of intended function.

The staff reviewed the applicant’s “detection of aging effects” program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the SC intended function(s) will be adequately maintained for license renewal under all CLB design conditions. The SRP-LR further states that this program element describes “when,” “where,” and “how” program data are collected, and that the method or technique and frequency may be linked to plant-specific or industry-wide operating experience, and to provide justification, including codes and standards referenced, that the frequency is adequate.

The staff does not find the applicant’s “detection of aging effects” program element to be adequate because the LRA does not contain sufficient information to describe all aspects of the activities to collect data. By letter dated April 5, 2011, the staff issued RAI B.2.5-1 (Q 2) requesting that the applicant state the testing frequency and timing.

In its response dated May 5, 2011, the applicant stated that the initial in-situ neutron attenuation testing will be conducted prior to the period of extended operation, and the projected testing population for this initial test campaign will consist of approximately 45 Boral® panels. The applicant also stated that the frequency of testing will be at least once every 10 years, with the interval shortened if operating experience indicates unacceptable degradation may occur prior to the next scheduled testing.

The staff finds the applicant’s response acceptable because the initial testing prior to the period of extended operation and the maximum 10-year inspection interval, informed by operating experience, is capable of detecting degradation of neutron attenuation properties such that the minimum B-10 areal density of 0.0300 g/cm^2 will be maintained. The staff noted that the applicant’s response is consistent with GALL Report AMP XI.M40 “Monitoring of Neutron-Absorbing Materials Other than Boraflex.” The staff’s concern described in RAI B.2.5-1 (Q 2) is resolved.

Based on its review of the application, and review of the applicant’s response to RAI B.2.5-1 (Q 2), the staff confirmed that the “detection of aging effects” program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4 and, therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.5 states that in-situ testing of Boral® will provide information on the effects of the SFP environment on the neutron attenuation capability of the Boral® panels. The applicant also stated that visual inspections will determine the extent of loss of material, and those inspections will be reported in a manner that allows trending of the results.

The staff reviewed the applicant's "monitoring and trending program" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and effect timely corrective or mitigative actions.

The staff noted that, in the response to RAI B.2.5-1 (Q 1-4) discussed above, the applicant amended the "monitoring and trending" program element to state that measurements of in-situ neutron attenuation tests will be compared to previous tests to determine whether degradation is occurring and if the degradation may affect Boral® function prior to the next scheduled test. The staff finds the amended "monitoring and trending" program element acceptable because the comparison of successive neutron attenuation test results is capable of determining whether the neutron absorption capacity of the Boral® material is diminishing and whether the minimum B-10 areal density of 0.0300 g/cm^2 will be maintained until the following testing activity is performed.

Based on its review of the application and review of the applicant's response to RAI B.2.5-1 (Q 1-4), the staff confirmed that the "monitoring and trending" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.5 and, therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.5 states that the acceptance criteria are based on an evaluation of thickness to monitor for swelling and that the thickness criteria will be established prior to the period of extended operation. The applicant also stated that changes in excess of acceptance criteria will require investigation and engineering evaluation to determine if further testing or corrective actions may be necessary. The applicant further stated that other parameters that will be examined for indication of Boral® degradation will include visual evidence of unusual geometric changes and the existence of areas of reduced boron density.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described.

The staff noted that, in the response to RAI B.2.5-1 (Q 1-4) discussed above, the applicant amended the "acceptance criteria" program element to state that neutron attenuation acceptance criteria will be determined based on confirming the B-10 areal density assumed in the SFP criticality analysis. The staff finds the amended "acceptance criteria" acceptable because maintaining the minimum 0.0300 g/cm^2 areal density will ensure that the Boral® intended function is maintained during the period of extended operation.

Based on its review of the application and review of the applicant's response to RAI B.2.5-1 (Q 1-4), the staff confirmed that the "acceptance criteria" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.5 summarizes operating experience related to the Boral® Monitoring Program. The applicant stated that the Boral® Monitoring Program is a new AMP proposed for the period of extended operation; therefore, no specific plant operating experience is available.

The staff noted that, in the response to RAI B.2.5-1 (Q 1-4) discussed above, the applicant amended the “operating experience” program element. The updated program element is reflected below.

Although the applicant does not have specific operating experience, industry operating experience was provided as modified by LRA Amendment 6.

The applicant stated that the Boral® neutron absorbing material is approved by the NRC for use at Davis-Besse and was first installed in 1999. The applicant stated that the Boral® material is a hot-rolled ceramic-metal (cermet) of aluminum and boron carbide clad in 1100 alloy aluminum. The applicant also stated that Boron carbide has high boron content and is physically stable and chemically inert and that Boral® provides a high cross-section for removing thermal neutrons. The applicant further stated that “1100 alloy aluminum provides corrosion resistance through an hydrated aluminum oxide film that develops on the surface, within a few days, after exposure to the atmosphere or water.”

The applicant cited the staff issued IN 2009-26 as industry operating experience on the degradation of neutron absorbing materials in SFP. The applicant stated that “IN 2009-26 addressed issues of degradation of the Carborundum neutron-absorbing materials and the deformation of Boral® panels in SFP.” The applicant stated that the operating experience discussed in IN 2009-26 on degradation of Boral is applicable to Davis-Besse. In particular, the applicant noted that IN 2009-26 described the Beaver Valley inspections in 2007 of the Boral® neutron absorber material coupons, which identified numerous blisters of the aluminum cladding. Subsequently, the applicant identified that the region 1 fuel storage racks have the potential to develop blisters that may displace water from the flux traps between storage cells and challenge dimensional assumptions used in the criticality analysis. The applicant stated that “FENOC determined that the Boral® aluminum cladding blistering was an aging effect and that it would credit the existing Boral® Surveillance Program with management of this aging effect at Beaver Valley.” The applicant also noted other operating experience from Susquehanna, where a significant bulge was identified in the Boral® material. The applicant stated that although the cause of the bulge at Susquehanna has not been definitively determined, hydrogen gas generation from either moisture contained in the Boral® at the time of manufacture or a leaking seal weld in the poison can may be the cause. The applicant also stated that this bulge prevented the placement of a blade guide into the deformed cell. The applicant further stated that the spent fuel racks at Davis-Besse are vented to prevent this condition.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that the operating experience of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered.

During its review, the staff found no industry operating experience to indicate that the applicant’s program would not be effective in adequately managing aging effects during the period of extended operation. Furthermore, the applicant appropriately considered industry operating experience in developing the Boral® Monitoring Program such that effects of aging will be adequately managed and Boral’s® intended function will be maintained during the period of extended operation.

The recent instances of degradation and deformation of SFP neutron-absorbing materials at nuclear plants (e.g., Palisades Nuclear Plant and Beaver Valley Power Station) have led the staff to re-evaluate guidance on neutron-absorbing materials other than Boraflex (i.e., LR-ISG-2009-01). The staff notes that the applicant should consider both plant-specific and industry operating experience in implementing the Boral® Monitoring Program. The applicant's plant-specific operating experience should be based on either data from inspection or monitoring programs or both, or from other operational findings. Using plant-specific operating experience or industry operating experience alone may not provide adequate assurance that the Boral® material will continue to perform its intended function. The applicant indicated that an initial in-situ test will be performed to measure the B-10 areal density of the Boral® panels prior to the period of extended operation. This will establish a baseline for the B-10 areal density reference measurements as well as plant-specific operating experience for the Boral® panels.

Based on its review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience, and the program, when implemented, can adequately manage the effects of aging on SSCs within the scope of the program. Therefore, the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10, and the staff finds it acceptable.

USAR Supplement. LRA Section A.1.5 provides the USAR supplement for the Boral® Monitoring Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in GALL Report AMP XI.M40 "Monitoring of Neutron-Absorbing Materials Other than Boraflex." The staff determined that the information in the Final Safety Analysis Report (FSAR) supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Boral® Monitoring Program, including the applicant's response to RAI B.2.5-1(Q 1-4), 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 USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.3 Collection, Drainage, and Treatment Components Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.9 describes the new Collection, Drainage, and Treatment Components Inspection Program as plant-specific. As modified in LRA Amendment 12, dated July 22, 2011, the applicant stated that this is a condition monitoring program consisting of visual and volumetric inspections of steel or other metallic components exposed to raw (untreated) water that are not covered by other AMPs. The applicant also stated that the program manages loss of material, cracking, or reduction of heat transfer through periodic inspections of representative samples to ensure that environmental conditions are not causing material degradation that could result in a loss of component intended function. As modified in LRA Amendment 13, dated August 17, 2011, the applicant stated that the aging effect of elastomers, exposed to raw water, will be monitored through a combination of visual inspection and manual or physical manipulation of at least 10 percent of available surface of the material. The applicant further stated that the first inspection will be conducted prior to entering the period of extended operation.

Staff Evaluation. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

Scope of Program. LRA Section B.2.9 states that this program includes visual inspections of the internal surfaces of copper alloy (including copper alloy greater than 15 percent Zn), gray cast iron, stainless steel (including CASS), and steel components exposed to untreated water—in collection, drainage, or treatment service—that are not covered by other AMPs. The applicant also provided a list of systems and components and the aging effects that are included in the scope of the program. In its LRA Amendment 13, dated August 17, 2011, in response to RAI 3.3.2.2.5-2, the applicant revised the program description to state inclusion of elastomeric components but did not add elastomeric components and the associated aging effect of hardening and loss of strength to this program element. This topic was discussed with the applicant in a teleconference on August 29, 2011. In its supplemental response to RAI 3.3.2.2.5-2 dated September 16, 2011, the applicant included elastomers as part of the scope of program section and identified hardening and loss of strength as an aging effect for elastomeric components in the "acceptance criteria" of the response. Although this program's element does not list this new aging effect within this section, per SRP-LR Section A.1.2.3.1, it is identified within the applicant's program as the aging effect to be managed associated with elastomers. The staff finds this acceptable because the specific structure, components, and aging effects managed by this program are now included. The staff's concern in RAI 3.3.2.2.5-2 associated with the inclusion to the scope of the program of elastomeric components subject to hardening and loss of strength is resolved.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the specific program necessary for license renewal should be identified. The SRP-LR also states that the scope of the program should include the specific SCs of which the program manages the aging.

The staff concluded that the applicant identified the components for which this program manages aging. The staff confirmed that the "scope of program" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.9 states that the Collection, Drainage, and Treatment Components Inspection Program is a condition monitoring program and does not include any actions to prevent or mitigate the effects of aging.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that, since condition or performance monitoring programs do not rely on preventive actions, this information need not be provided. Since this is a condition monitoring program, the staff concluded that this program does not rely on preventive actions.

The staff confirmed that the "preventive actions" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.9 states that inspections of the surfaces of collection, drainage, treatment, and other miscellaneous components will be performed during maintenance and surveillance activities when the surfaces are accessible for inspection. In the initial version of the program, the applicant stated that if opportunities for inspection do not arise, then a focused inspection will be performed. The applicant also stated that parameters monitored or inspected are directly related to degradation of the components under review and include visible evidence of material degradation due to loss of material (corrosion), as well as due to cracking of susceptible materials or reduction of heat transfer (fouling) for susceptible components.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states, in part, that for a condition monitoring program, the parameters monitored or inspected should detect the presence and extent of aging effects.

The staff reviewed LRA Section B.2.9 and noted that the program does not provide the details for what parameters, such as wall thickness and periodic heat balance calculations, will be monitored and used to ensure adequate aging management will be completed. By letter dated June 20, 2011, the staff issued RAI B.2.9-5 asking the applicant to state what parameters will be linked to detecting aging effects during visual inspections and explain the basis for detecting loss of material on inaccessible surfaces.

In its response dated July 22, 2011, the applicant provided a table listing the three aging effects being managed with the corresponding parameters monitored. In addition, the applicant revised the "aging effects" program element to state that volumetric inspections will detect loss of material on inaccessible surfaces, such as tank bottoms sitting on concrete. The staff finds the applicant's response acceptable because the applicant provided an appropriate link between the parameters being monitored and aging effects being managed, as described in SRP-LR Section A.1.2.3.3. Additionally, the applicant provided an appropriate approach for detecting loss of material on inaccessible surfaces. The staff's concern described in RAI B.2.9-5 is resolved.

In LRA Amendment 13, dated August 17, 2011, the applicant added elastomers to this program and revised the "parameters monitored or inspected" program element to state that the aging effects for elastomers, exposed to raw water, will be monitored through a combination of visual and manual or physical manipulation (at least 10 percent of available surface) of the material. The staff finds this acceptable because the applicant provided an appropriate methodology for the parameters being monitored and the aging effect involved consistent with the GALL Report and SRP-LR Section A.1.2.3.3 recommendations. The applicant's Amendment 13 does not state, for this program element, that the addition of elastomeric components now includes an additional aging effect of hardening and loss of strength. In its supplemental response to RAI 3.3.2.2.5-2, dated September 16, 2011, the applicant identified hardening and loss of strength as an aging effect in the "acceptance criteria" program element. Although this is contrary to SRP-LR Section A.1.2.3.3, the program now includes a specific identification of the aging effect for elastomers within this program. The staff finds this acceptable because there is a clear and specific link between the component being managed, elastomers, and the aging effect to be managed within this program, hardening, and loss of strength.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.9 states that visual inspections (VT-3 or equivalent) will be performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR Part 50, Appendix B. The applicant stated that these inspections will detect a loss of material or fouling of surfaces prior to a loss of component function and will be performed when component surfaces are accessible during maintenance, repair, and surveillance activities. The applicant also stated that if opportunistic inspections have not occurred prior to the end of the current operating license, then a focused inspection, inclusive of each material in the scope of the program, will be performed prior to entering the period of extended operation. The applicant further stated that inspections will be supplemented by enhanced visual inspections of components susceptible to cracking and will be combined with an evaluation of conditions by qualified personnel to detect cracking of susceptible materials exposed to raw (untreated) water, at temperatures above 140 °F, or with ammonia or ammonium compounds present, prior to a loss of component function.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the SC intended function(s) will be adequately maintained for license renewal under all CLB design conditions. The SRP-LR further states that this program element describes "when," "where," and "how," program data is to be collected.

The staff reviewed LRA Section B.2.9 and noted that visual inspections (VT-3 or equivalent) will be performed to detect loss of material, fouling, and cracking. However, ASME Code Section III, Subsection IWA-2213, states that VT-3 examinations are conducted to determine the general mechanical condition of components and their supports. In contrast, ASME Code Section III, Subsection IWA-2211, states that VT-1 examinations are conducted to detect discontinuities and imperfections on the surface of components including such conditions as cracks, wear, corrosion, and erosion. The staff also noted that a comparable AMP, GALL Report AMP XI.M32, "One-Time Inspection," recommends VT-1 or equivalent for detecting crevice and pitting corrosion. Therefore, VT-3 or equivalent inspections may be satisfactory to detect general corrosion but not necessarily an acceptable method to detect crevice or pitting corrosion. By letter dated May 2, 2011, the staff issued RAI B.2.9-1 requesting the applicant to justify that VT-3 or equivalent inspections will detect pitting and crevice corrosion.

In its response dated June 3, 2011, the applicant revised the program to state that it will use VT-1 or equivalent visual inspections. The staff finds this acceptable because the program's inspection method is now consistent with industry standards and is capable of detecting the aging effects under consideration. The staff's concern described in RAI B.2.9-1 is resolved

The staff reviewed LRA Section B.2.9 and also noted that, if opportunistic inspections have not occurred prior to the period of extended operation, then a focused inspection will be performed. SRP-LR Section A.1.2.3.4, "detection of aging effects," states that the parameters to be monitored include aspects such as frequency and sample size and notes that the basis for the inspection population and sample size should be based on service environment for locations most susceptible to the aging effect. The SRP-LR also states that programs should include provisions for expanding the sample size when degradation is detected in the initial sample. The lack of details defining a "focused" inspection did not provide the staff with sufficient information to complete its review. Since raw water environments are not consistent with time, it was unclear to the staff why a one-time, opportunistic approach would be sufficient to manage the effects of aging. By letter dated June 20, 2011, the staff issued RAI B.2.9-3 requesting the applicant to provide details of the "focused" inspection for those components and materials not subject to opportunistic inspections.

In its response dated July 22, 2011, the applicant revised the program from opportunistic inspections to periodic inspections of representative samples on a 10-year interval, with the first inspection scheduled prior to the period of extended operation. The applicant stated that the sample will comprise 20 percent of the population up to a maximum of 25 components and will be determined by engineering evaluation, focused on the components considered most susceptible to aging degradation. The applicant also stated that evidence of degradation will be documented and evaluated through the Corrective Action Program and provided its sample expansion criteria. The staff finds this acceptable because the program will now perform periodic inspections, which can better account for inconsistencies in the raw water environment, and because the applicant identified the frequency, sample size, and sample expansion criteria of these inspections. In addition, the applicant revised the “detection of aging effects” program element to state that volumetric inspections will detect loss of material on inaccessible surfaces, such as tank bottoms sitting on concrete. The staff finds this acceptable because the applicant provided an appropriate approach for detecting loss of material on inaccessible surfaces. The staff’s concern described in RAI B.2.9-3 is resolved.

In LRA Amendment 13, dated August 17, 2011, the applicant added elastomers to this program and revised the “detection of aging effects” program element to state that the aging effects for elastomers, exposed to raw water, will be monitored through a combination of visual and manual or physical manipulation (at least 10 percent of available surface) of the material. The staff finds this acceptable because the applicant provided an appropriate approach for detecting aging effects of elastomers exposed to raw water.

The staff confirmed that the “detection of aging effects” program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.9 states that the inspection findings that do not meet the acceptance criteria will be evaluated and tracked through the Corrective Action Program. The applicant stated that susceptible locations will be monitored and that degradation of surfaces exposed to raw (untreated) water will be evaluated to determine other potentially susceptible locations. The applicant also stated that trending of previous inspection results may be used as a qualitative tool to identify susceptible locations that may require additional examinations.

The staff reviewed the applicant’s “monitoring and trending” program element against the criteria in SRP-LR Section A.1.2.3.5, which states, in part, that there should be a description of the monitoring and trending activities, the parameter or indicator trended, and the methodology for analyzing the inspection or test results against the acceptance criteria.

The staff reviewed LRA Section B.2.9, and noted that the applicant provided an adequate description of the monitoring and trending activities, including additional inspections of other potentially susceptible locations. The staff confirmed that the “monitoring and trending” program element satisfies the criteria defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.9 states that indications or relevant conditions of degradation detected during the inspections will be compared to pre-determined acceptance criteria. The applicant also stated that unacceptable inspection findings will include visible evidence of cracking, loss of material, or reduction of heat transfer due to fouling that could lead to loss of component intended function during the period of extended operation.

The staff reviewed the applicant’s “acceptance criteria” program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. The staff noted that the applicant did not identify from where it derived the pre-determined acceptance criteria. By letter dated May 2, 2011, the staff issued RAI B.2.9-2 asking the applicant to justify the basis of the pre-determined acceptance criteria, such as manufacturer’s recommendations, industry standards, or other justified basis.

In its response dated June 3, 2011, the applicant stated that the basis for the acceptance criteria includes design standards, procedural requirements, CLB, industry codes or standards, and engineering evaluation. The applicant also stated that the acceptance criteria for metallic surfaces are any indications of relevant degradation and that, consistent with the SRP-LR, acceptance criteria that do not allow degradation are based on maintaining intended functions under all CLB conditions. The staff finds this acceptable because the applicant clarified the basis and descriptions of its acceptance criteria by stating that any relevant degradation will be identified, which is consistent with the guidance in SRP-LR Section A.1.2.3.6 for maintaining the intended function under all CLB conditions. The staff's concern described in RAI B.2.9-2 is resolved.

The staff confirmed, that the "acceptance criteria" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.9 summarizes operating experience related to the Collection, Drainage, and Treatment Components Inspection Program. The applicant stated that the operating experience confirms that periodic surveillance and maintenance activities and as-needed repairs are conducted for components exposed to raw (untreated) water. The applicant further stated that reviews of operating experience identified two instances where maintenance and surveillance activities identified degradation; however, they were determined to be acceptable and did not impact component intended function. The applicant also stated that review of Davis-Besse operating experience did not identify other failures that could be attributed to frequent or prolonged exposure to raw water in the systems covered by this AMP. The applicant also stated that industry and plant-specific operating experience will be considered in the development and implementation of this program and that, as additional operating experience is obtained, lessons learned will be incorporated, as appropriate.

The staff reviewed this information against the criteria in SRP-LR Section A.1.2.3.10, which states that operating experience with existing programs should be discussed and should consider past corrective actions resulting in program enhancements or additional programs. During its review of past operating experience, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

SRP-LR Section A.1.2.3.10 also states that an applicant may have to commit to provide operating experience in the future for new programs to confirm their effectiveness; however, LRA Appendix A.3, Table A-1, "License Renewal Commitment List," does not have a commitment to provide operating experience in the future to confirm the effectiveness of the new Collection, Drainage, and Treatment Components Inspection Program.

By letter dated June 20, 2011, the staff issued RAI B.2.9-4 asking the applicant to commit to perform a review of operating experience in the future to confirm the effectiveness of the program or to justify not performing such a review.

In its response dated July 22, 2011, the applicant stated that its previous response to RAI B.1.4-1, dated June 24, 2011, included Commitment No. 43 regarding future reviews of plant-specific and industry operating experience to confirm the effectiveness of the license renewal AMPs. The staff finds this acceptable because, consistent with SRP-LR Section A.1.2.3.10, the applicant's future operating experience reviews will confirm the effectiveness of this AMP and will determine the need for program enhancements or the development of new AMPs. The staff's concern described in RAI B.2.9-4 is resolved.

Based on its review of the application, and review of the applicant's response to RAI B.2.9-4, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criteria in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.9 provides the USAR supplement for the Collection, Drainage, and Treatment Components Inspection Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in SRP-LR Table 3.3-2. The staff also notes that the applicant committed (Commitment No. 4) to implement the new Collection, Drainage, and Treatment Components Inspection Program prior to entering the period of extended operation for managing aging of applicable components. The staff determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Collection, Drainage, and Treatment Components Inspection Program, the staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.4 Leak Chase Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.25, as amended by letter dated August 17, 2011, describes the existing plant-specific Leak Chase Monitoring Program as a condition monitoring program enhanced to monitor borated water leakage through floor and wall monitoring pathways comprising the leak chase system. The LRA states that the program through periodic monitoring manages detrimental aging effects that could lead to loss of intended function(s) for the SFP, the fuel transfer pit, and the cask pit liners leak chase system. The applicant stated that the program will include a recurring preventive maintenance activity to inspect and clean the leakage pathways every 18 months. Through periodic observations, and in conjunction with the PWR Water Chemistry Program, and TS requirements, the program monitors the SFP treated borated water level and detects the location, amount, and rate of leaks due to loss of material in liners and liner weldments through the leak chase system. Monthly measurements of leakage from any line exceeding 10 ml will be subject to boron analysis. Samples having leakage rates of 15 ml/min will be documented in a condition report and evaluated for possible increases in monitoring frequency and other corrective actions. Furthermore, collected leakage will be analyzed monthly for pH and semiannually for iron content. Results will be monitored and trended to ensure there is no corrosion of the reinforcing bars in the walls or floor of the pool and pits. In addition, the applicant stated that this program will annually inspect accessible outside walls and the floor (from the ceiling side) of the pool and pits, documenting indications of migrating leakage in the Corrective Action Program.

Staff Evaluation. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3 and Table A.1-1. The staff's review focused on how the applicant's program manages aging effects by effectively incorporating these program elements. The staff's evaluation of each of these elements follows.

<u>Scope of Program</u>. LRA Section B.2.25 states that the scope of the Leak Chase Monitoring Program is to monitor the aging effects in the SFP, fuel transfer pit, and cask pit stainless steel liners due to the loss of material.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific structures and components for which the program manages aging. The staff noted that the LRA discusses not only the monitoring of borated water leakage but also the monitoring and detection of aging effects for the leak chase system, its components, and the associated concrete structures. Specifically, LRA B.2.25 states that the Leak Chase Monitoring Program will monitor borated water leakage from the SFP, the fuel transfer pit, and the cask pit stainless steel liners due to age-related degradation. In its "scope of program" program element, the LRA also states that the Leak Chase Monitoring Program is credited with detecting loss of material in the liners and further focuses the program on the integrity of the liner welds. In its "operating experience" program element, the LRA provides a review of the impact of previous leakage on the leak chase system (channels, valve bodies, etc.) and on the contiguous concrete structures. The LRA further states that traces of borated water were detected on the concrete of the auxiliary building, but there are no concerns regarding the strength or integrity of the structure. The same program element discusses inspecting the liner welds and monitoring the tell-tale drains and the applicant's actions to unclog the drains. LRA Table 3.5.2-2, "Aging Management Review Results—Auxiliary Building," states that the PWR Water Chemistry Program and the Leak Chase Monitoring Program are credited to manage the aging effects of the SFP liner. The applicant stated that TS are used to monitor the sufficiency of the water in the SFP.

In its review of the "scope of the program" program element, the staff determined that it needed further clarification and better definition of the scope of the program because not only does it address monitoring the amount of SFP leakage and loss of material for the liners and the liner weldments, but it also discusses the integrity of the SFP structure and of the structural commodities and components of the leak chase system. By letter dated April 5, 2011, the staff issued RAI B.2.25-1 requesting the applicant provide the full scope of the program and address whether it focuses only on the borated water leakages or if the program also manages aging effects for the entire leak chase system, including its materials, commodities, components, and structures exposed to borated water. In addition, the staff requested the applicant to specify if the program includes components of the leak chase system and to identify sections in the AMR results tables where the applicant addressed the management of aging effects for the wall and floor channels, tubes, trenches, and valve casings.

In its response dated May 24, 2011, the applicant stated that the purpose of the Leak Chase Monitoring Program is to monitor liner leakage and manage the loss of material in the spent fuel, cask, and fuel transfer pit liners as described in rows 8, 14, and 28 of LRA Table 3.5.2-2, "Aging Management Review Results—Auxiliary Building," and LRA Section B.2.25 "Scope" element. The applicant also stated that the program does not manage aging effects for the carbon steel leak chase channels and collector tubes in concrete, which are structural bulk commodities reviewed in LRA Table 3.5.2-13, "Aging Management Review Results—Bulk Commodities." The applicant further stated that the stainless steel piping and valves in the SFP cooling and cleanup system are managed by the PWR Water Chemistry and the One-Time Inspection Programs. The applicant also stated that the unlined trenches are part of the cask pit, fuel transfer pit, and spent fuel pit concrete structures, listed in LRA Table 3.5.2-2, and hence are managed by the Structures Monitoring Program.

The staff finds the applicant's response acceptable because it clarifies the scope of the program and focuses it solely on the leakage and aging management of the spent fuel, cask, and fuel transfer pit liners and liner welds. The staff's concern described in RAI B.2.25-1 is resolved.

The staff determined that the "scope of the program" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.25 states that the Leak Chase Monitoring Program is a condition monitoring program and does not include activities for prevention or mitigation of aging effects.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that condition or performance monitoring programs do not rely on preventive actions and, thus, this information need not be provided.

The staff determined that the "preventive actions" program element of the Leak Chase Monitoring Program is consistent with the corresponding element of SRP-LR Section A.1.2.3.2 because the program is a condition monitoring program and does not need to include preventive actions.

The staff determined that the "preventive actions" program element satisfies the criterion in SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.25 states the Leak Chase Monitoring Program will detect loss of material in stainless steel SFP, fuel transfer pit, and cask pit liners by periodically checking and recording the amount of leakage collected through the zone drains in the leak detection drain valves. The applicant also stated that the program includes provisions for monitoring and recording leak rates through the volumetric method. LRA Table 3.5.1, item 3.5.1-46 (group 5: fuel pool liners) and Table 3.5.2-2, row 28, states that the program monitors the SFP water, per Davis-Besse TS.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the "parameters monitored or inspected" program element recommends the identified parameters be linked to the degradation of the particular SCs intended function(s). For a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects, which, in accordance with the GALL Report and SRP-LR, are loss of material due to pitting and crevice corrosion and cracking due to SCC of the SFP, the fuel transfer pit, and the stainless steel cask pit liners.

The staff reviewed the "parameters monitored or inspected" program element in LRA Section B.2.25 against that of SRP-LR Section A.1.2.3.3. The staff determined that additional clarifications are needed to assess the program element's consistency with the SRP-LR guidelines because, in the "parameters monitored or inspected," the applicant states that the program only monitors the amount of borated water leakage through the tell-tale drains linked to the zone valves. The staff noted that there is no discussion in the LRA of the TS mandated weekly surveillance of the water level in the SFP, or how these could be related in monitoring the condition of the leak chase drainage system and its materials exposed to borated water. There is also no discussion of water evaporation during the monthly accumulations of borated water in the leak chase system, which could lead to increasingly acidic water that could accelerate aging effects on channels, tubes, trenches, and valve bodies and also result in faulty readings in boron concentrations. In addition, the staff also determined the need to have a description of the materials and commodities used in the construction of the leak chase drainage system, how they are impacted by the acidic leakage, and how the applicant tracks the variation in the acidity of the borated water. Furthermore, it was not clear to the staff what additional parameters are monitored to ensure the leak chase drainage system will continue to perform its intended function adequately during the period of extended operation. Therefore, by letter dated April 5, 2011, the staff issued RAI B.2.25-2 requesting the applicant to identify:

- the type of materials used in the leak chase drainage system
- their anticipated degradation by the borated water, if any
- the relationship of the collected leakage to the level of water in the SFP
- the chemical elements and parameters monitored, with their acceptance criteria included

In its response dated May 24, 2011, the applicant stated that the SFP leak chase system is part of the SFP cooling and cleanup system. The applicant stated that piping and valves associated with the leak chase system are fabricated of stainless steel, and the leak chase channels are carbon steel structural shapes that are stitch-welded to the vertical liner plates. The assembly of plates and channels were used as formwork when placing concrete, and hence the channels are considered bulk commodities embedded in concrete. The collector tubes are assumed to be carbon steel and are considered to be bulk commodities for the same reason as the leak chase channels are. Other system components include unlined concrete leak trenches (channels) beneath the liner floor plates. The applicant further stated that for the leakage observed from the leak chase monitoring system, a leak rate of 1 gal. per day is very small when compared to the 300,000 gal. capacity of the fuel pool, where an inch of water depth corresponds to a volume of 660 gal. of water. The monitoring of the leakage is used to evaluate long-term changes in the condition of the liner and not in the volume of the water or its level in the pool. The applicant also stated that its implementing procedure monitors for boron concentration in the leakage but does not include the routine monitoring of other chemicals or parameters. The applicant stated that it did not observe degradation of the leak chase structural or cooling and cleanup system components. The applicant also stated that the boric acid, migrated into the concrete as a result of clogged leak monitoring lines, also did not cause degradation of the concrete and further referenced RAI B.2.39-2, where it provided historical leakage records and details on how to manage borated water aging effects for the pool, documented in SER Section 3.0.3.2.15.

The staff reviewed the applicant's response to RAI B.2.25-2 and confirmed that the LRA addresses management of aging effects for the referenced items in rows 1 and 2 of LRA Table 3.5.2-13 as bulk commodities, which are reviewed in SER Section 3.5.2.3.13, "Containment, Structures, and Components Supports—Bulk Commodities—Aging Management Review Results—LRA Table 3.5.2-13." The staff determined that the applicant's response to manage aging effects of borated water leakage on the relevant SSCs by the Structures Monitoring Program, discussed in the applicant's response to RAI B.2.25-2 above, is acceptable.

The staff further determined that the applicant's focus of the program in monitoring the borated water and its long term impact on the liners is also acceptable. The staff, however, was concerned with the frequency and adequacy of the chemical analysis of the obtained leakage samples. Although the applicant indicated in RAI B.2.39-2 that it analyzes the leakage for both boron and iron, the staff noted that the acidity and the iron content of the collected leakage was not analyzed on a regular basis, but only when the chemicals are detectable. The staff further noted that the infrequent sampling and limited analyses could result in delayed detection of degradation for the concrete and steel, which could compromise the integrity and functionality of the SFP and of the embedded leak chase system. By letter dated July 21, 2011, the staff issued followup RAI B.2.39-10, requesting that the applicant provide more details on the frequency of the chemical analysis (e.g., as that carried out in 1996) of the collected leakage to ensure its acidity (pH) remains comparable to that of the pool, and its iron content is minimal. The staff finally noted that the current analysis of the collected leakage is limited to boron content and is inadequate to identify concrete and steel degradations. These chemical analyses performed in a timely fashion (pH, monthly; iron, semiannually) will ensure that the leakage is not contributing to concrete degradation and loss of material for steel, which otherwise could diminish the integrity and functionality of the SFP during the period of extended operation.

In its response dated August 17, 2011, the applicant stated that to date, plant-specific operating experience and a contractor's report have shown the effects of borated water on concrete and reinforcing steel to be relatively minor. However, the applicant also stated that it commits (Commitment No. 30) to conduct chemical analyses of the collected SFP leak chase drainage for pH on a monthly basis, and for its iron content, semiannually. Since there is no history of chemical analyses for any parameters other than boron, the initial acceptance criteria for pH are set at 7.0–8.0 with future adjustments based on analyses reflecting actual plant-specific operating experience. To ensure that corrosion in the reinforcing steel is not taking place, within 3 years after the initiation of monitoring and trending of the leakage's iron content, specific acceptance criteria will be introduced for the affected areas of the pool and pits. Although there are rust-stained cracks in the refueling canal concrete, upon investigation it was determined that its reinforcing steel had not been adversely impacted. For effective monitoring of concrete and steel reinforcement, in 2014 and 2020 and as necessary thereafter, the applicant stated that it will take core bores of the affected areas for testing followed by visual inspections of the reinforcement and analysis for corrosion products. Degradations will be recorded in the Corrective Action Program and evaluated to determine the repairs needed, if any, so that the pool and pits will continue to perform their intended functions during the period of extended operation. Additionally, the applicant stated that the core bore evaluations will determine whether the SFP leakage has affected the concrete and reinforcing steel in a manner that is not bounded by the industry and Davis-Besse current operating experience.

The staff reviewed the applicant's response to RAI B.2.39-10 for this program element and noted that the applicant will monitor the collected leakage's pH and iron content by amending the LRA and enhancing the AMP. The staff determined that the applicant's initial acceptance criteria for boron acidity set at pH of 7.0-8.0 to be acceptable because a mildly acidic leakage sample indicates minor concrete degradations. Semiannual monitoring of iron content in the leakage for 3 years prior to establishing a specific measure for corrosion is also acceptable because the selected time span will provide ample data to be correlated with that obtained from the 2014 and 2020 core bores for the degree and volume of ongoing corrosion. Moreover, periodic adjustments of these parameters supplemented with core bores when warranted would enhance the acceptance criteria and the evaluation of the affected structures. The staff also finds the applicant's annual visual inspections of the accessible outside walls and floor of the pool and pits to monitor and document leakage in the Corrective Action Program acceptable. This action would yield accurate and timely records that could act as an early warning of potentially increased migration of the leakage through the affected areas. SER Section 3.0.3.2.15 discusses the staff's evaluation of additional information related to monitoring and inspection of reinforced concrete degradation.

The staff finds the applicant's response acceptable because it provides an integrated and comprehensive approach, in conjunction with the Structures Monitoring Program, to monitor the condition of the SFP/pit stainless steel liners, leak chase system, and the supporting structure(s) through chemical analyses, physical testing, and visual inspections before loss of their intended function(s). The staff's concerns for this program element described in RAI B.2.25-2 and in RAI B.2.39-10 are resolved.

The staff determined that the "parameters monitored or inspected" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.25 states the Leak Chase Monitoring Program performs a monthly inspection for water leakage in the leak chase system. The program monitors the amount and rate of water leakage across the drain zones. Leakage in excess of 10 ml from any zone drain valve is further analyzed for its boron content, and findings are recorded in the work order system for its early determination and localization. Moreover, LRA Table 3.5.2-2, "Aging Management Review Results—Auxiliary Building," states that there are two programs that manage the aging effects of the SFP liner: the PWR Water Chemistry Program and the Leak Chase Monitoring Program. Monitoring of the SFP water level is in accordance with Davis-Besse TS requirements.

The staff reviewed the applicant's "detection of aging effects" program element in LRA Section B.2.25 against the criteria for this program element described in SRP-LR Section A.1.2.3.4. The "detection of aging effects" program element states that detection of aging effects should occur before there is a loss of the SCs' intended function(s). The program element should address aspects such as methods or techniques (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection used, and the timing of new or one-time inspections to ensure timely detection of aging effects. In accordance with the SRP-LR and the GALL Report, aging effects and mechanisms that require detection are loss of material and SCC. Timing for the detection of aging effects is based on plant-specific or industry-wide operating experience.

Following the review, the staff determined that additional clarification was needed to assess the "detection of aging effects" program element's adequacy for detecting aging effects, because it is not clear to the staff how the applicant correlates the monthly collected information of the borated water leakage and its analysis to the weekly TS' surveillance of the SFP water level. The LRA does not state how this information provides timely detection and localization of leakages in the leak chase system and its associated components and structures, including cracking due to SCC and loss of material due to pitting and crevice corrosion. It is also not clear if the applicant uses any additional detection techniques capable of identifying the continued functionality of the system during the period of extended operation.

By letter dated April 5, 2011, the staff issued RAI B.2.25-3 requesting that the applicant detail how the TS and Leak Chase Monitoring Program detect loss of material and SCC in the liners and leak chase system, and, since this program is a condition monitoring program and its inspections are either visual or volumetric, what detection method (e.g., boroscopes, fiber optics), other than monitoring the amount of borated water leakage, the program employs to ascertain the integrity of the leak chase channels (i.e., they remain unclogged and intact, devoid of rust and accumulated boric acid) during the monthly leakage collections.

In its response dated May 24. 2011, the applicant stated that pool water temperature is kept below 140 °F; therefore, SCC is not an aging effect applicable to the Davis-Besse SFP liner. Therefore, neither the TS nor the Leak Chase Monitoring Program is credited for this aging effect. Instead the applicant credits the PWR Water Chemistry Program and the Leak Chase Monitoring Program for managing the loss of material aging effect for the pool liner. The applicant also stated that it follows GALL Report Table III, item A5-13 and NUREG-1833, "Technical Bases for Revision to the License Renewal Guidance Documents," recommendations to monitor leakage for evaluations and potential corrective actions and to manage the aging effects of the SFP liner. The applicant further stated that monitoring the sufficiency of water in the SFP is also critical for the removal of the iodine gap activity released from ruptured irradiated fuel assemblies. For the detection method ascertaining the integrity of the leak chase system, the applicant noted that operating experience indicated that open lines with very low leak rates could become clogged with boric acid due to evaporation of the water within the lines. Hence, for leakage monitoring of these low output lines with measurements of just a few ml/min, the applicant took corrective action to maintain the isolation valves closed. The applicant finally stated that the Leak Chase Monitoring Program specifies only periodic visual monitoring of leakage rates with no other examination techniques (e.g., use of boroscopes, fiber optics).

The staff reviewed the applicant's response and noted that the applicant's PWR Water Chemistry Program is consistent with no exceptions or enhancements to the GALL Report AMP XI.M2, "Water Chemistry," Program. The staff's evaluation of the PWR Water Chemistry Program is documented in SER Section 3.0.3.1.15. The staff also noted that the PWR Water Chemistry Program includes periodic monitoring and control of the known detrimental contaminants that could lead to, or are indicative of conditions for, the onset of loss of material and that it is also supplemented by the One-Time Inspection Program. The staff further reviewed the GALL Report for Group 5 Structures (Fuel Storage Facility, Refueling Canal) and NUREG-1833 and noted that for borated water, they recommend the use of the Water Chemistry Program to mitigate loss of material, cracking, and reduction in heat transfer; the TS to monitor the level of water in the SFP; and the leak chase channels to monitor leakage.

The staff finds the applicant's response to RAI B.2.25-3 part (1) acceptable because the pool temperature is maintained below 140 °F and its environment non-corrosive. The applicant documented in its response to RAI 3.3.1.39-1 dated June 3, 2011, the temperature ranges for the pool environment and noted that USAR Sections 1.2.8.2.4 and 9.1.3.3.1 state that the SFP cooling system is designed to maintain the borated SFP water temperature below 125 °F. Moreover, the applicant noted that even in the case of a partial core discharge, it maintains the SFP temperature below 133 °F during maximum normal heat load conditions as stated in USAR Section 9.1.3.1, which is also below the 140 °F threshold for SCC to occur. The staff determined the applicant's approach to manage loss of material is also acceptable because the applicant will use the Leak Chase Monitoring Program, the PWR Water Chemistry Program, and the supporting One-Time Inspection Program to detect aging effects in the SFP, the fuel transfer pit, and the cask pit stainless steel liners and weldments. These programs employ chemical, visual, and volumetric testing methods to ensure their effectiveness. The surveillance requirements of Davis-Besse's TS ensure the sufficiency of water in the SFP. The staff's concern described in RAI B.2.25-3 for part (1) is resolved.

To resolve part (2) of RAI 2.25-3, by letter dated July 21, 2011, the staff issued RAI B.2.39-10 (followup to RAI B.2.39-2) requesting the applicant provide technical justification on the frequency of its visual inspections and the use of boroscopes or other instruments to detect any adverse impact the leaking borated water may have had on the functionality of the leak chase system and on the surrounding concrete.

In its response dated August 17, 2011, the applicant stated that the total leakage rate is very small (typically on the order of 2 ml/min) and will be kept from migrating through the concrete walls of the pool and pits by ensuring that leak chase zones with the most leakage are continuously drained and that all leak chase associated commodities are physically cleared. The applicant indicated that it is not possible to visually verify (through boroscopes or other video equipment) that 100 percent of the leakage passageways are clear because of the way they were constructed or embedded in the concrete. Instead, the applicant stated that it will perform preventive maintenance activities every 18 months (beginning prior to entering the period of extended operation) to detect and ensure that there is no obstruction on the inside of the leak chase piping. To reinforce the adequacy of the 18-month frequency, the applicant will annually inspect and document the accessible outside walls and floor of the pool and pits for evidence of leakage. The applicant further stated that it has not identified any water migration through the walls since 2001. However, in 2007, about 20 months after the last inspection and cleaning of the drain lines, leakage was identified in the ceiling of a room located below the SFP. In 2011, about 42 months after the previous inspection and cleaning of the drain lines, leakage migration was detected again.

The staff reviewed the applicant's response to RAI B.2.39-10 for this program element and noted that the applicant amended its LRA to include the analysis of the collected leakage for boric acid and iron content and enhanced the program element to include detection and cleaning of obstructed channels every 18 months. The staff finds the applicant's approach to minimize borated water migration into the concrete acceptable, because when the leak chase zones with the most leakage remain open and the leak chase commodities are unobstructed, borated water will not accumulate in the drainage zones and migrate into the surrounding concrete. The staff determined the applicant's approach to use, instead of boriscopic/camera-based examination, the alternate methods of (1) annual visual inspections of accessible walls and floors for evidence of leakage and (2) cleaning obstructed leakage channels periodically (every 18 months) also acceptable because the two methods based on operating experience provide adequate and timely detection of aging concrete and for the affected steel reinforcement and the leak chase system commodities. Hence, the staff finds the applicant's approach to detect leakage and maintain the drainage zones functional acceptable because, through prescribed periodic monitoring and preventive measures, the applicant will ensure that borated water will not accumulate in the leak chase system, and the system will continue to fulfill its intended function during the period of extended operation. The staff's concerns for this program element described in RAI B.2.25-3 part 2 and RAI B.2.39-10 are resolved.

The staff determines that the "detection of aging effects" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.25 states that the Leak Chase Monitoring Program performs leakage inspections to monitor the loss of borated water. The applicant, based on the volume and length of time involved to collect the sample, calculates the rate of leakage. For collected leakage greater than 10 ml, the boron concentration is measured and recorded. Leak chase channel results are reviewed, and adverse conditions are documented in the Corrective Action Program and further summarized in system health reports.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should predict the extent of degradations to trigger timely corrective or mitigative actions. The SRP-LR also states that plant-specific and industry-wide operating experience may be considered in evaluating appropriate techniques and frequencies. In addition, it states that the program element should support quantifiable aging indicators and parameters monitored to compare ongoing collected data for trending and future predictions.

Following the staff's review of LRA Section B.2.25 "monitoring and trending" program element, the staff determined that additional information is needed to assess its acceptability. The staff finds that the applicant's proposed leakage collection efforts of monthly monitoring and trending may not be in accordance with industry-wide frequency of monitoring and trending activities to initiate corrective actions. The staff noted that other plants perform the same inspection in a shorter time period and was concerned that monthly monitoring and trending would not initiate timely corrective actions to mitigate aging effects impacting the SSCs. Specifically, the staff noted that in a letter dated July 31, 2006, in response to the "Industry Groundwater Protection Initiative Questionnaire," FENOC stated that leakage monitoring at its Beaver Valley Station is performed daily, while at the Perry Nuclear Power Plant it is done weekly. It was not clear to the staff how the applicant's approach to trend a degrading liner environment or leak chase drainage system is consistent with industry standards. The staff notes that Class I are SSCs designed to remain functional if the safe-shutdown earthquake ground motion occurs. The LRA does not state how the monthly activities of leakage collection, analysis, and recording could provide a timely prediction of the extent of liner degradation or forward trending of anticipated leakages for the SFP, which, in accordance with LRA Section 2.4.2 and USAR Sections 3.2.1.2, is a Seismic Class I structure.

By letter dated April 5, 2011, the staff issued RAI B.2.25-4 requesting the applicant to justify the monthly monitoring of leakage at Davis-Besse. Specifically, the staff requested an explanation of how the trending of leakage rates and monitoring of boron concentrations help predict the integrity of the leak chase system, including the liner of the Seismic Class I structure.

In its response dated May 24, 2011, the applicant reiterated its earlier statement in response to RAI B.2.25-3 that leakage is very small and its monitoring is primarily to assess the condition of the liner and structural materials, not the water level in the SFP. The applicant also stated that it is not aware of any industry standard for such monitoring frequency, which may differ from site to site due to pool configuration and liner status. The applicant also stated that the absence of drainage could be confirmed during operator walkdowns; however, visual observations are often insufficient to monitor small leakages. A monthly monitoring frequency for leakage is sufficient to identify long-term changes in the leakage-affected structures. A leak rate acceptance criterion from the SFP monitoring channels is established to monitor long-term changes in the liner or leak chase system that warrant investigation or corrective actions.

The staff reviewed the applicant's response to RAI B.2.25-4 and noted that the applicant uses leakage to monitor its early determination and localization. The staff noted that monitoring leak rate in conjunction with other programs, which were previously discussed, could help identify changes in the condition of the liner. The staff also noted that although operating experience may vary with configuration and status, there are examples of plants with leakage rates similar to Davis-Besse that perform leakage collection on a daily basis. The staff further noted that, in accordance with IN 2004-05 dated March 3, 2004, "Spent Fuel Pool Leakage to Onsite Groundwater," leakages, if not identified in a timely fashion, could potentially be deleterious to SSCs and the environment. By letter dated July 21, 2011, the staff issued RAI B.2.25-7 (followup to RAI B.2.25-4), requesting the applicant to identify any actions taken subsequent to the issue of IN 2004-05 and to discuss if leakage rates in excess of 15 ml/min, stated in Commitment No. 30, would be considered enough to warrant an increased frequency in monitoring.

In its response dated August 17, 2011, the applicant stated that for the monitoring and trending element, there is no direct leakage measurement over an extended period of time (e.g., gal. per day or per month). The apparent discrepancy of units in the collected leakage as gal/day (or month) versus the acceptance criteria units of ml/min is due to a rough conversion of a typical leakage collected over a 40 minute period and recalculated to yield the equivalence of gal/day, which is used for a comparison of the trickling leakage to the volume of water contained in the SFP. In response to IN 2004-05, the applicant initiated CR 04-01719, dated March 5, 2004, to evaluate the staff's concerns at Davis-Besse. The applicant stated that in March 2003 it initiated CR 03-02360 and completed it in 2005. The condition report addressed similar concerns as those stated in IN 2004-05 but was applicable to an INPO operating experience report for Salem. The Davis-Besse condition report prompted (1) verification that the leak collection isolation valves were not clogged with boric acid and cleaning or replacing them as necessary, and (2) the collection of adequate number of soil samples to determine if there was a soil contamination due to an SFP/cask pit leakage.

In addition, the applicant stated that in January 2007 it followed up with CR 07-13318, which focused on observed boric acid on the ceiling of the room below the SFP. After a 7 month effort of unclogging (e.g., through steam cleaning or wire brushing) and clearing the leak chase system tell-tale drains and valves, leakage migration from the pool to the ceiling was eliminated. In 2011, however, boric acid was observed again on the same ceiling leading to the initiation of CR 11-90368, which dealt with the same issues as the previous CR. As a corrective action for CR 11-90368, a triennial preventive maintenance activity was established to verify that the leak monitoring lines were clear and cleaned as needed.

For part (2) of the corrective action, the applicant initiated a periodic sampling of the groundwater for tritium contamination from Monitoring Well-18 (MW-18), which is within 75 ft from the south wall of the auxiliary building/ SFP/cask pit. The minimum sampling frequency for MW-18 is once every 5 years. However, since July 28, 2004, the applicant indicated that it has collected and analyzed samples from MW-18 four more times, concluding that no tritium had leaked from the SFP/cask pit to the environment. Background tritium concentration in sampled area groundwater (including Lake Erie) range from 178 to 348 picoCuries per liter (pCi/L). The collected samples had tritium concentrations lower than that observed in the July 28, 2004, sampling. The highest concentration of the recent tritium sample was 436 pCi/L. The other recent samples have been below the 348 pCi/L background level. The applicant further stated that since 2009, the sampled results are reported in the "Combined Annual Radiological Environmental Operating Report and Radiological Effluent Release Report," which includes observation and sampling of current and new wells for radionuclides, including tritium, as part of the plant's implementation of the NEI Groundwater Protection Initiative. The applicant also stated that in its "Groundwater Monitoring Well Installation and Monitoring Report," dated March 18, 2008, it notes that the SFP, fuel transfer canal, and cask pit are potential sources of elevated tritium detected in groundwater due to past instances of leakage. Finally, the applicant stated that Davis-Besse in August 2007 added 16 new groundwater monitoring wells in six distinct locations to the many already existing onsite wells to sample for radionuclides, including tritium.

The staff reviewed the applicant's response and finds its explanation regarding the apparent discrepancy in the leakage rate measurements of ml/min versus gal/day, as well as the approach used to monitor and collect the leakage for analysis, acceptable. Regarding the response of the applicant to IN 2004-05, for part (1) the staff noted that the applicant increased its preventive maintenance from a triennial occurrence to 18 months. The staff determined this to be acceptable because it provides an increased monitoring of the tell-tale drains ensuring they remain open during the period of extended operation. For part (2), the staff reviewed the "Davis-Besse Nuclear Power Station 2008 Annual Radiological Environmental Operating Report" (ML091480342), and confirmed the applicant's claim of 436 pCi/L for the MW-18 well. The staff also reviewed the "Davis-Besse Nuclear Power Station 2009 Annual Radiological Environmental Operating Report" (ML101410508), and noted that the collected sample from MW-18 well still yielded a low level tritium concentration of 332 pCi/L. The staff, therefore, determined that the applicant's statement that no evidence exists to indicate leakage from the SFP/cask pit to the environment to be acceptable because the annual data reported to the staff of the tritium concentration in the groundwater, including its fluctuations, is in agreement with that occurring naturally in the environment. The staff's concerns described in RAI B.2.25-4 and RAI B.2.25-7 are resolved.

The staff determined that the "monitoring and trending" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.25 states that the acceptance criteria guidelines for potential corrective actions are based on periodic observations of increased leak rates on a particular zone valve. It also states that adverse trends (continued increases of leak rates on a particular zone valve) are documented in the Corrective Action Program.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6 and Table A.1-1, which states that the acceptance criteria of the program and their basis should be described so that the need for corrective actions is evaluated. The SRP-LR also states that acceptance criteria should be specific and quantifiable to ensure that the SCs' intended function(s) remain (including replacement) 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. The SRP-LR further states that the acceptance criteria should provide for timely corrective action before loss of intended function(s), thus meeting the criteria set under CLB.

The staff reviewed information presented in LRA Section B.2.25 relevant to the "acceptance criteria" program element of the Leak Chase Monitoring Program. The staff determined that additional clarifications are needed to ensure its consistency to the general criteria provided by the SRP-LR. The staff noted that although the SRP-LR guidance recommends sound quantitative or qualitative acceptance criteria for the periodic inspections, the "acceptance criteria" program element in the LRA does not provide specific numerical values of increasing leak rates, which would initiate the need for corrective actions. The staff also noted that acceptance criteria are neither specific nor quantifiable but rather subjective depending on the review of the collected data by the responsible system engineer. It is also not clear to the staff what constitutes "abnormal" data. In addition, the applicant did not state what methodology it uses to analyze the collected sample results against industry applicable acceptance criteria.

By letter dated April 5, 2011, the staff issued RAI B.2.25-5 requesting the applicant identify the threshold of an unacceptable or adverse increase in leakage rates of borated water that would constitute the basis to trigger corrective actions and what they would be. The staff also requested the applicant state if some drain zones are permitted to have more leakage than others.

By letter dated May 24, 2011, the applicant responded to RAI B.2.25-5 stating that LRA Table A-1 is revised to include a new license renewal commitment (Commitment No. 30) to enhance the Leak Chase Monitoring Program "acceptance criteria" element such that a measurement of leakage from any monitoring line exceeding 15 ml/min will be documented in the applicant's Corrective Action Program for evaluation and potential corrective actions, which could be repairs or other actions to prevent recurrence. The applicant also stated that each drain zone has the same leakage acceptance criteria.

The staff finds the applicant's response acceptable because, in accordance with SRP-LR, the applicant provided specific and quantifiable acceptance criteria, and Commitment No. 30, to ensure that the liner's intended function(s) remain functional for all CLB design conditions during the period of extended operation. The staff's concerns described in RAI B.2.25-5 are resolved.

The staff determined that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6; therefore; the staff finds it acceptable.

Operating Experience. LRA Section B.2.25 summarizes operating experience, related to the Leak Chase Monitoring Program, which states that leakage outside the leak chase drains has been observed in several places over the years. The most extensive leakage was found during 2000-2001 on the walls and ceiling of the ECCS Pump Room. The leakage was stopped, and there are no concerns regarding the integrity of the affected concrete. The LRA also states that during the re-racking of the SFP during Cycle 13, the applicant performed an underwater investigation in the SFP to ensure that the integrity of the liner welds was maintained. The LRA further states that weld issues could not be found; therefore, the applicant performed an examination of the leak chase system to identify if it was clogged. The applicant used borated water leakage monitoring to detect and define potential aging effects on the affected SSCs.

The staff reviewed this information against the acceptance criteria in the SRP-LR, Appendix A, Section A.1.2.3.10 and Table A.1-1 for objective evidence that the effects of aging will be adequately managed so that the SCs will continue to perform their intended function(s) during the period of extended operation. In accordance with SRP-LR, the recommended objective evidence should be associated with the AMP's operating experience and past corrective actions resulting in program enhancements or additional programs. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions.

The staff determined that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.25 provides the USAR supplement for the Leak Chase Monitoring Program. The staff reviewed the USAR supplement description of the program and noted that it does not conform to the recommended description for this type of program as described in SRP-LR Revision 2, Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems," and Table 3.5-2, "Aging Management Programs Recommended for Containments, Structures, and Component Supports." The SRP-LR recommends that plant-specific AMPs comply with Appendix A and should contain information associated with the bases for determining that aging effects (loss of material in the stainless steel liners) will be managed during the period of extended operation.

By a letter dated April 5, 2011, the staff issued RAI B.2.25-6 requesting the applicant to identify the aging effects being managed and summarize the activities of the program. In its response to RAI B.2.25-6 dated May 24, 2011, the applicant stated that the program manages loss of material for the SFP, the fuel transfer pit, and the cask pit liners, as described in its "scope of program" program element, but believes that the level of detail in LRA Section A.1.25 is consistent with that identified in SRP-LR Tables 3.0-1 and 3.5-2. The applicant also stated that the summary provides the basis for managing the aging effects for the liners and briefly describes the program activities (i.e., leakage monitoring). The staff reviewed the applicant's response to RAI B.2.25-6 and noted that the applicant's USAR description of the AMP activities reported in the LRA still was not clear. By letter dated July 21, 2011, the staff issued RAI B.2.25-8 (followup to RAI B.2.25-6), requesting the applicant revise the USAR to appropriately reflect the material, environment, and aging effect the program manages for the SFP, the fuel transfer pit, and the cask pit liners.

In its response dated August 17, 2011, the applicant indicated that it revised its LRA Section A.1.25, "Leak Chase Monitoring Program," to reflect the material environment, and aging effect the program manages for the SFP, the fuel transfer pit, and the cask pit liners.

The staff reviewed the applicant's claim and finds the revised USAR supplement acceptable because it meets the criteria of SRP-LR. It summarizes the applicant's integrated approach to manage the aging effects for the SFP, the fuel transfer, and the cask pit liners in conjunction with the PWR Water Chemistry Program and the use of the TS requirements to monitor SFP water level. It also provides details on what and how often components and commodities will be inspected and collected leakage samples will be analyzed for potential degradations. The staff's concerns described in RAI B.2.25-6 and RAI B.2.25-8 are resolved.

The staff also notes that in LRA Amendment No. 13 dated August 17, 2011, the applicant revised its commitment (Commitment No. 30) to document in its Corrective Action Program leakages that exceed 15 ml/min to include analyses of collected samples for pH and iron content, inspection and unclogging of tell-tale drains every 18 months, and annual inspections of accessible concrete surfaces for evidence of migrating leakage. The revised commitment provides consideration for more frequent monitoring, evaluations, and corrective actions for effective management of applicable aging effects during the period of extended operation.

The staff determined that the information in the revised USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Leak Chase Monitoring Program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21.

3.0.3.3.5 Nickel-Alloy Management Program

Summary of Technical Information in the Application. LRA Section B.2.28 describes the existing Nickel-Alloy Management Program as plant-specific. The Nickel-Alloy Management Program manages cracking due to PWSCC and SCC or IGA for nickel-alloy components in the RCS other than the upper RPV head. The applicant stated that the program meets the GALL Report recommendation to have a plant-specific program for managing nickel-alloy materials.

The applicant stated that the Nickel-Alloy Management Program is a combination of a mitigative and condition monitoring program. The applicant's mitigative actions include replacement of highly susceptible nickel-alloy components with materials known to be less susceptible to PWSCC and SCC or IGA or repair of those components through weld overlay, weld inlay (also known as weld underlay), mechanical stress improvement process, or surface conditioning. The applicant's condition monitoring portion of the program uses many inspection techniques to detect cracking, including volumetric and bare metal visual examinations.

By letter dated July 27, 2011, the staff issued RAI B.2.28-1 requesting that the applicant provide information to confirm that 10 CFR 50.55a(g)(6)(ii)(F) requirements and ASME Code Case N-770-1, "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 Application of Listed Mitigation Activities," would be implemented. In its response dated August 17, 2011, the applicant stated that 10 CFR 50.55a(g)(6)(ii)(F) would be implemented in accordance with the regulations. Furthermore, the applicant committed (Commitment No. 49) to meet the requirements of ASME Code Case N-770-1 as modified by 10 CFR 50.55a(g)(6)(ii)(F) prior to the period of extended operation. The staff finds the applicant's response acceptable because the applicant confirmed that 10 CFR 50.55a(g)(6)(ii)(F) requirements and ASME Code Case N-770-1 will be implemented prior to the period of extended operation. The staff's concern described in RAI B.2.28-1 is resolved.

The applicant noted that this program implements component evaluations, examination methods, scheduling, and site documentation as required for compliance with 10 CFR Part 50, the ASME Code, NRC Bulletins, NRC GLs, and staff-accepted industry guidelines related to nickel-alloy issues. The applicant explained that this program implements strategies to ensure long-term operability of nickel-alloy components. Further, the staff found this program was developed using ASME Section XI Subsection IWB, ASME Code Case N-770-1, ASME Code Case N-722, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated With Alloy 600/82/182 Materials," and certain industry programs, most notably Materials Reliability Program (MRP)-126, "Generic Guidance for Alloy 600 Management," and MRP-139, "Primary System Piping Butt Weld Inspection and Evaluation Guideline," which were issued under NEI 03-08, "Guideline for the Management of Materials Issues," protocols.

<u>Staff Evaluation</u>. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements, as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

<u>*Scope of the Program*</u>. LRA Section B.2.28 states that all nickel-alloy locations within the RV, pressurizer, SG, and reactor coolant (hot and cold leg) piping are included within the scope of this program, with certain exceptions that are covered by other specific programs (e.g., aging of SG tubes is managed by the Steam Generator Tubing Integrity Program).

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific SCs of which the program manages the effects of aging.

The staff reviewed the applicant's "scope of program" program element and found that it met the current regulatory requirements for the identified components. The staff notes that while the applicant currently maintains items such as full structural weld overlayed nickel-alloy butt welds under the ISI requirements, as appropriate under MRP-139 requirements, a recently published final rule (NRC–2008–0554), dated June 21, 2011, requires the use of ASME Code Case N-770-1, as conditioned in 10 CFR 50.55a(g)(6)(ii)(F), to establish a long-term inspection program for these welds. The staff notes, in response to RAI B2.28-1, that the applicant acknowledged the future implementation of N-770-1, as conditioned and noted that this program would be updated as warranted. This action, and the staff's review of the scope, demonstrate that this program has been adequately scoped and will be a living program to adjust to future regulatory requirements concerning nickel-alloy components.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.28 states several preventive actions by describing various mitigation techniques including, full structural weld overlay, weld inlay, mechanical stress improvement, and component replacement. The applicant noted that specific mitigation strategies will be determined by plant-specific and industry operating experience.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that preventive and mitigation programs should be described. These actions should mitigate or prevent aging degradation.

The staff has reviewed the techniques noted by the applicant as part of this program. Most methods have been used at numerous plants to mitigate the effect of PWSCC. Predominately, full structural weld overlays are used to remove the structural need for highly susceptible weld material to maintain a weld's integrity. Mechanical stress improvement has been used at several plants to put compressive stresses on and near the inside surface of a pipe in an attempt to prevent or limit the growth of SCC and crack initiation. Replacement of Alloy 600 components with less susceptible materials, either Alloy 690 or stainless steel components, is an effective long-term solution. Therefore, the staff finds the applicants identified mitigation techniques are adequate to prevent aging degradation.

Additionally, implementing the industry initiative MRP-139 and noting the incorporation of ASME Code Case N-770-1, with NRC conditions, into the program demonstrates that the program is a living document updated with the latest requirements for various mitigation techniques that are available for use to address nickel-alloy components and numerous more options, which are being explored to address the mitigation of active degradation mechanisms for these components. In addition, the applicant, in January 2010, received NRC approval to use optimized weld overlays to mitigate reactor coolant pump (RCP) discharge nickel-alloy butt welds from the effects of PWSCC (ADAMS Accession No. ML100271531). The staff finds that the applicant's program demonstrates effective consideration of various mitigation techniques available.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.28 states that the Nickel-Alloy Management Program monitors for cracking in nickel-alloy components that are exposed to reactor coolant through the use of bare metal visual, surface, and volumetric examination techniques.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which state that the parameters to be monitored or inspected should be identified and be able to detect the presence and extent of aging effects.

The staff noted that the applicant's program is monitoring and inspecting to identify the degradation mechanisms of concern, PWSCC, and SCC or IGA. Visual examinations are employed to detect evidence of leakage from pressure retaining components within the RCS due to cracking or discontinuities and imperfections on the surface of the components. Volumetric examination is employed to detect the presence of cracking/discontinuities throughout the volume of material. The staff notes that the applicant's program uses the appropriate volumetric, surface, and visual non-destructive evaluation techniques for detection of degradation of the components identified in the scope of the program, as required by 10 CFR 50.55a and industry guidance. These regulatory and industry programs are considered adequate to monitor and inspect for PWSCC and SCC or IGA.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.28 states that the Nickel-Alloy Management Program uses various visual, surface, and volumetric examination techniques for early detection of PWSCC in Alloy 600 components. The applicant stated that the frequencies of these inspections are developed to ensure that components meet required design attributes and maintain their availability to perform their intended function.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that detection of aging effects should occur before there is a loss of the SCs intended function. The parameters to be monitored or inspected should be appropriate to ensure that the SC intended function will be adequately maintained for license renewal under all CLB design conditions.

The staff's review found the applicant's program uses the 10 CFR 50.55a inspection requirements for ISI and staff-accepted industry guidance. The NRC has approved, in accordance with 10 CFR 50.55a, the specific techniques and frequencies for monitoring nickel-alloy components for those components examined in accordance with the Inservice Inspection Program. In addition, for other items included in the scope of the applicant's program, the methods and frequencies of examination are recommended in industry guidance. Each of these programs for the detection of aging effects has been analyzed by the NRC to provide adequate detection capability.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.28 states the Nickel-Alloy Management Program uses various methods to detect and size cracks in nickel-alloy pressure boundary components. The applicant stated that the program ranks the nickel-alloy components for inspection based on susceptibility to cracking in accordance with NRC regulations and industry guidance.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. Plant-specific or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency.

The staff's review found that the applicant's program uses the 10 CFR 50.55a inspection requirements for ISI and staff-accepted industry guidance. In general, the tools for monitoring and trending of nickel-alloy component inspection programs are based on the scope and reporting requirements established by the ASME Code as required by 10 CFR 50.55a. The staff notes that ASME Code, Section XI requires, "recording of examination and test results that provide a basis for evaluation and facilitate comparison with the results of subsequent examinations." ASME Code, Section XI also requires, "retention of all inspection, examination, test, and repair/replacement activity records and flaw evaluation calculations for the service lifetime of the component or system." ASME Code, Section XI, additionally provides rules for "additional examinations" (i.e., sample expansion), when flaws or relevant conditions are found that exceed the applicable acceptance criteria, to assist in determination of an extent of condition and causal analysis.

The staff notes that each of the methods identified by the applicant for the detection of aging effects have been analyzed by the NRC to provide adequate detection capability. In addition, NRC temporary instructions for the NRC inspection of some of these industry programs have been developed, such as the case of Temporary Instruction 2525/172, which defines NRC inspection of applicant actions to complete the MRP-139 program noted within the scope of the applicant's program. The NRC has found these programs are adequate to monitor the degradation mechanism and has in place trending tools to ensure operational experience is reviewed to establish these criteria.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.28 states that the Nickel-Alloy Management Program evaluations and acceptance criteria comply with industry standards (e.g., ASME Code) or meet the acceptance of the NRC. The applicant stated that based on these evaluations, a flaw is accepted by analytical evaluation or corrected by a repair or replacement activity prior to start-up.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described and should ensure the SC intended functions are maintained under all CLB design conditions during the period of extended operation.

The staff's review found that the applicant's program uses the 10 CFR 50.55a inspection requirements for ISI and staff-accepted industry guidance. In general, the acceptance criteria of such programs are established by the ASME Code, implementation of which is as required by 10 CFR 50.55a. The staff notes that ASME Code, Section XI, IWB-3000, contains acceptance criteria appropriate for the RCPB components examined in accordance with Section XI. Application of these criteria ensures that nickel-alloy components in the RCPB maintain their designed function under all required CLB design conditions.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.28 summarizes operating experience related to the applicant's Nickel-Alloy Management Program. The applicant stated that operating experience at Davis-Besse is evaluated, and modifications to the program are implemented to ensure that the Nickel-Alloy Management Program is effective. This is accomplished by promptly identifying and documenting issues using the Corrective Action Program. The applicant further stated that industry operating experience, self-assessments, and independent audits provide additional assurance that the program remains effective.

The applicant provided an example of mitigation and inspection of the HPI safe end to nozzle weld and decay heat 12 in. branch connection to elbow overlay weld. The applicant stated that NRC inspectors evaluated the inspection and overlay and found it was performed by qualified personnel and any deficiencies identified were appropriately dispositioned and resolved. The applicant further stated that as of September 2008, seven welds had been mitigated by full structural weld overlays and had received volumetric examinations.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that operating experience with existing programs should be discussed. Further, SRP-LR Section A.1.2.3.10 states that past corrective actions resulting in program enhancements or additional programs should be considered. This information should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended functions will be maintained during the period of extended operation.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation. The staff review noted the numerous proactive mitigative actions performed at Davis-Besse to address nickel-alloy degradation. In addition, the staff found that the applicant proactively addressed an inspection issue that exists for most B&W reactor designs for their RCP discharge welds. The applicant mitigated the welds by implementing the first use of optimized weld overlays, which not only mitigated the nickel-alloy butt welds from the effects of PWSCC but also resolved inspection coverage issues for future weld inspection. The staff finds that this operational experience does provide an adequate basis to demonstrate that the applicants program will adequately manage degradation during the period of extended operation.

Based on its review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.28 as revised in response to RAI B2.28-1 dated August 17, 2011, provides the supplement for the Nickel-Alloy Management Program. The staff reviewed this supplement description of the program and notes that it conforms to the types of recommended descriptions of similar programs, as described in SRP-LR Table 3.1-2. The staff determined that the information in the supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Nickel-Alloy Management Program, the staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.6 PWR Reactor Vessel Internals Program

Summary of Technical Information in the Application. LRA Section B.2.32 describes the new PWR Reactor Vessel Internals Program as plant-specific. The applicant stated that the PWR Reactor Vessel Internals Program will manage the following aging effects for the PWR Reactor Vessel Internals (RVIs) at Davis-Besse:

- change in component dimensions due to void swelling
- cracking due to flaw initiation, flaw growth, SCC/(IGA), and irradiation-assisted stress corrosion cracking (IASCC)
- loss of preload due to stress relaxation
- reduction in fracture toughness due to radiation and thermal embrittlement
- loss of material due to wear

The applicant stated that the PWR Reactor Vessel Internals Program is based on the examination requirements for B&W-designed PWRs provided in EPRI MRP Topical Report 1016596, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines" (MRP-227), Revision 0, along with the implementation guidance described in NEI 03-08, "Guideline for the Management of Materials Issues." The applicant stated that MRP-227 has been submitted to the NRC for review and approval. The applicant also stated that following NRC approval, MRP-227 will be revised to incorporate any necessary changes to the guidelines and reissued as MRP-227-A, and the Davis-Besse PWR Reactor Vessel Internals Program will be revised, as necessary, to incorporate the final recommendations and requirements published in MRP-227-A. The applicant stated that the PWR Reactor Vessel Internals Program is a new plant-specific program for Davis-Besse. According to the applicant, there is no corresponding AMP described in the GALL Report. Therefore, the applicant evaluated the program against the 10 elements described in SRP-LR Section A.1.2.3.

By letter dated September 16, 2011, the applicant provided Amendment No. 15 to the Davis-Besse LRA. LRA Amendment 15 revised, in its entirety, the discussion of the PWR Reactor Vessel Internals Program in LRA Section B.2.32, the USAR supplement description of the PWR Reactor Vessel Internals Program in LRA Section A.1.32, and USAR supplement Commitment No. 15 in the LRA USAR supplement, Table A-1. The revisions to these LRA sections were provided to support the applicant's September 16, 2011, response to the staff's July 11, 2011, RAI B.2.32-1 concerning the PWR Reactor Vessel Internals Program at Davis-Besse. Further revisions to LRA Sections B.2.32 and A.1.32 were provided by letter dated March 9, 2012, under LRA Amendment 24, as part of the applicant's supplemental response to RAI B.2.32-1. The staff's July 11, 2011, RAIs and the applicant's September 16, 2011 and March 9, 2012 RAI responses concerning the PWR Reactor Vessel Internals Program are discussed in the staff evaluation subsection.

LRA Amendments 15 and 24 Section B.2.32 Program Description. LRA Section B.2.32, as revised by LRA Amendments 15 and 24, describes the PWR Reactor Vessel Internals Program as a new program that will be consistent with the 10 elements of an effective AMP, as described in the GALL Report, Revision 2, December 2010, Chapter XI, GALL Report AMP XI.M16A, "PWR Vessel Internals," without exceptions or enhancements.

The applicant stated that the PWR Reactor Vessel Internals Program relies on implementation of EPRI Report No. 1022863, "Pressurized Water Reactor Internals Inspection and Evaluation

Guidelines (MRP-227-A)," and EPRI Report No. 1016609, "Materials Reliability Program: Inspection Standard for PWR Internals (MRP-228)," to manage the aging effects on the RVI components.

The applicant stated that the program will be used to manage the effects of age-related degradation mechanisms that are applicable in general to the PWR RVI components at Davis-Besse. The applicant stated that these aging effects include:

- various forms of cracking, including SCC, which encompasses IASCC, PWSCC, and cracking due to fatigue and cyclic loading
- loss of material due to wear
- loss of fracture toughness due to thermal aging and neutron irradiation embrittlement
- loss of preload due to thermal and irradiation-enhanced stress relaxation or creep
- changes in dimension due to void swelling

The applicant stated that the program includes management of the TLAA identified in LRA Section 4.2.7 for reduction in fracture toughness of the RVI. The applicant also stated that this TLAA will be managed in accordance with the implementation of the MRP-227-A guidelines including all activities associated with Davis-Besse's responses to plant-specific action items identified in Section 4.2 of the final SE for MRP-227-A.

The applicant stated that the program applies the guidance in MRP-227-A for inspecting, evaluating, and, if applicable, dispositioning nonconforming components at Davis-Besse. The applicant also stated that the program conforms to the definition of a sampling-based condition monitoring program, as defined by the Branch Technical Position (BTP) RSLB-1, with periodic examinations and other inspections of highly-affected internals locations. According to the applicant, these examinations provide reasonable assurance that the effects of age-related degradation mechanisms will be managed during the period of extended operation. The applicant stated that the program includes expanding periodic examinations and other inspections if the extent of the degradation effects exceeds the expected levels.

The applicant stated that the MRP-227-A guidance for selecting RVI components for inclusion in the inspection sample is based on a four-step ranking process. According to the applicant, the RVIs were assigned to one of the following four groups: Primary, Expansion, Existing Programs, and No Additional Measures components. The applicant stated that definitions of each group are provided in GALL Report Chapter IX.B.

The applicant stated that the result of the four-step sample selection process is a set of Primary Component locations for each of the three plant designs that are expected to show the leading indications of the degradation effects, with another set of Expansion Component locations that are specified to expand the sample should the indications be more severe than anticipated. The applicant also stated that the degradation effects in a third set of RVIs locations are deemed to be adequately managed by existing programs, and a fourth set of RVIs locations are deemed to require no additional measures. According to the applicant, the program typically identifies 5−15 percent of the RVIs locations as Primary Component locations for inspections, with another 7–10 percent of the internal locations to be inspected as Expansion Components, as warranted by the evaluation of the inspection results.

The applicant stated that another 5–15 percent of the RVIs locations are covered by existing programs, with the remainder requiring no additional measures. The applicant stated that this process uses appropriate component functionality criteria, age-related degradation susceptibility criteria, and failure consequence criteria to identify the components that will be inspected under the program in a manner that conforms to the sampling criteria for sampling-based condition monitoring programs in Section A.1.2.3.4 of NRC Branch Position RLSB-1. The applicant concluded that the sample selection process is adequate to assure that the intended function(s) of the PWR RVI components are maintained during the period of extended operation.

The applicant stated that the program's use of visual examination methods in MRP-227-A for detection of relevant conditions (and the absence of relevant conditions as a visual examination acceptance criterion) is consistent with the ASME Code, Section XI rules for visual examination. The applicant also stated that the program's adoption of the MRP-227-A guidance for visual examinations goes beyond the ASME Code, Section XI visual examination criteria because additional guidance is incorporated into MRP-227-A to clarify how the particular visual examination methods will be used to detect relevant conditions and describes in more detail how the visual techniques relate to the specific internal components and how to detect their applicable age-related degradation effects.

The applicant stated that the technical basis for detecting relevant conditions using volumetric UT inspection techniques can be found in MRP-228, where the review of existing bolting UT examination technical justifications has demonstrated the indication detection capability of at least two vendors, and where vendor technical justification is a requirement prior to any additional bolting examinations. The applicant also stated that the capability of the program's UT volumetric methods to detect loss of integrity of PWR internals bolts, pins, and fasteners, such as baffle-former bolting in B&W and Westinghouse units, has been well demonstrated by operating experience. The applicant stated that the program's adoption of the MRP-227 guidance and process incorporates the UT criteria in MRP-228, which calls for the technical justifications that are needed for volumetric examination method demonstrations, as required by the ASME Code, Section V.

The applicant stated that the program also will account for future industry operating experience, as incorporated in periodic revisions to MRP-227-A. The applicant also stated that the program provides reasonable assurance for the long-term integrity and safe operation of RVIs in all commercial operating U.S. PWR nuclear power plants.

The applicant stated that age-related degradation in the RVIs is managed through an integrated program. The applicant also stated that specific features of the integrated program are addressed in the 10 program elements. According to the applicant, degradation due to changes in material properties (e.g., loss of fracture toughness) was considered in the determination of inspection recommendations and is managed by the requirement to use appropriately degraded properties in the evaluation of identified defects. The applicant stated that the integrated program will be implemented through an inspection plan.

The applicant stated that the program will address all plant-specific action items applicable to Davis-Besse that are established in Section 4.2 of the final SE for MRP-227-A. The applicant also stated that a plant-specific inspection plan for ensuring the implementation of MRP-227-A program guidelines and Davis-Besse's responses to the plant-specific action items, as identified in Section 4.2 of the final SE, will be submitted for NRC review and approval.

Staff Evaluation. In its August 27, 2010 LRA submittal, Section B.2.32, the applicant described the new PWR Reactor Vessel Internals Program as a plant-specific program, based on there being no corresponding AMP described in the GALL Report. Therefore, the applicant evaluated the program against the 10 elements described in SRP-LR Section A.1.2.3. The staff determined that the applicant's use of the acceptance criteria for the 10 program elements from SRP-LR Section A.1.2.3 to be appropriate given that the PWR Reactor Vessel Internals Program is a new program that is plant-specific relative to Revision 1 of the SRP-LR and Revision 1 of the GALL Report.

The staff noted that the PWR Reactor Vessel Internals Program, as discussed in the original LRA Section B.2.32 and the USAR supplement (including the commitment table), will implement the industry guidelines for aging management of PWR RVI components, which are described in MRP-227, and the program will be revised, as necessary, to incorporate the final recommendations and requirements that are published in MRP-227-A. The staff determined that this statement is appropriate because it requires that the PWR Reactor Vessel Internals Program be revised in accordance with the staff-approved version of MRP-227 (MRP-227-A).

The staff noted that MRP-227-A requires license renewal applicants' PWR Reactor Vessel Internals Programs to address all conditions, limitations, and applicable plant-specific action items identified in Revision 1 of the staff's final SE for MRP-227, Revision 0, which was issued by letter dated December 16, 2011. MRP-227-A includes Revision 1 of the staff's final SE for MRP-227 as an attachment.

As documented in its final SE for MRP-227, the staff reviewed MRP-227 and determined that its guidance will generally provide acceptable levels of quality and safety with respect to inspection and evaluation of RVI components in PWRs supplied by Westinghouse, B&W, and Combustion Engineering. Notwithstanding this determination, the staff determined that some issues were not adequately resolved regarding the implementation of MRP-227. Several of these issues are identified in Section 4.1 of the final SE for MRP-227 as "Conditions and Limitations on the Use of MRP-227, Revision 0. " The SE Section 4.1 conditions and limitations are generic to all plants implementing MRP-227 guidelines, and, as such, the MRP-227 guidelines were amended to address the conditions and limitations identified in Section 4.1 of the staff's final SE, and re-issued as MRP-227-A.

Section 4.2 of the final SE for MRP-227, identifies applicant plant-specific action items that will need to be addressed on a plant-specific basis by license renewal applicants with renewed facility operating licenses. The action items address topics related to plant-specific implementation of MRP-227 that could not be effectively addressed on a generic basis in MRP-227.

Applicant action item No. 8 from Section 4.2 of the final SE for MRP-227 specifies that applicants shall make a submittal for NRC review and approval to credit their implementation of MRP-227, as amended by the final SE, as an AMP for the RVI components at the facility. The AMP submittal shall include the information identified in Section 3.5.1 of the final SE. Section 3.5.1 of the final SE specifies that an applicant's application to implement MRP-227, as amended by the final SE, shall include the information identified in items (1) and (2) from Section 3.5.1 of the final SE, which are summarized below:

(1) An AMP for the facility that addresses the 10 program elements in GALL Report Revision 2 AMP XI.M16A.

(2) To ensure the MRP-227 program and the plant-specific action items will be carried out by applicants, applicants are to submit an inspection plan that addresses the applicable

plant-specific action items for staff review and approval consistent with the licensing basis for the plant.

Section 3.5.1 of the final SE also specifies that applicants who submit LRAs after the issuance of the final SE shall, in accordance with GALL Report Revision 2, submit the information identified in items (1) and (2) above, as well as the information identified in items (3) through (5) of Section 3.5.1 of the final SE for staff review and approval:

(3) Those applicants for license renewal referencing MRP-227, as approved by the staff, for their RVIs AMP shall ensure that the programs and activities specified in MRP-227, as approved by the NRC, are summarily described in the FSAR supplement.

(4) For plant CLBs that include mandated inspection or analysis requirements for RVIs either in the operating license for the facility or in the facility TS, the applicant shall compare the mandated requirements with the recommendations in the NRC-approved version of MRP-227. If the mandated requirements differ from the recommended criteria in MRP-227, as approved by the NRC, the requirements in the applicable license conditions or TS take precedence over the MRP recommendations, and the applicant shall comply with the applicable license conditions or TS.

(5) Applicants who implement MRP-227, as approved by the NRC, shall evaluate the CLB for their facilities to determine if they have plant-specific TLAAs of RVIs that shall be addressed in accordance with 10 CFR 54.21(c)(1). If so, the applicant's TLAA shall be submitted for NRC review along with the applicant's application to implement the NRC-approved version of MRP-227.

Although the applicant's August 27, 2010, LRA submittal preceded the issuance of the final SE for MRP-227, Revision 0, and GALL Report Revision 2, the staff determined that it would be appropriate to review the applicant's program relative to the elements of an acceptable PWR Reactor Vessel Internals AMP described in GALL Report Revision 2 AMP XI.M16A, including the extent to which the program will address information in items (1) through (5) above.

In RAI B.2.32-1, issued by letter dated July 11, 2011, the staff requested that the applicant revise the discussion of the PWR Reactor Vessel Internals Program in LRA Section B.2.32 and the corresponding USAR supplement section in LRA Section A.1.32 to address, to the extent possible, each of these five AMP information requirements identified in Section 3.5.1 of the final SE for MRP-227, Revision 0, as specified by action item No. 8 from Section 4.2 of the final SE. As discussed in the RAI, the staff recognized that the applicant may not be able to fully address information item No. (2) from Section 3.5.1 of the final SE, which requires the detailed inspection plan and responses to action items identified in Section 4.2 of the final SE. Accordingly, the staff requested that, for the inspection plan, including those action items requiring detailed submittals, the applicant provide the appropriate USAR supplement commitment to submit the inspection plan, including the responses to the plant-specific action items.

By letter dated September 16, 2011, the applicant provided its response to RAI B.2.32-1. In its response to RAI B.2.32-1, the applicant stated that the Davis-Besse RVI Program provided in LRA Section B.2.32 and the corresponding USAR supplement (LRA Section A.1.32) are revised, in accordance with LRA Amendment 15, to address each of the five plant-specific AMP information requirements identified in Section 3.5.1 of the final SE for MRP-227. The applicant stated that LRA Amendment 15, Sections B.2.32 and A.1.32 replace the original LRA sections for this program in their entirety. The applicant also stated that USAR supplement Commitment

No. 15 is revised to address the requirement for submitting the inspection plan, as required by AMP information requirement No. 2. The applicant provided LRA Amendment 15, Sections B.2.32 and A.1.32, and USAR supplement Commitment No. 15 as an enclosure to its RAI response.

As part of its response to RAI B.2.32-1, the applicant summarized the program revisions, as they apply to each of the five plant-specific AMP information requirements identified in Section 3.5.1 of the final SE for MRP-227:

(1) Regarding item No. (1) from Section 3.5.1 of the final SE, the applicant stated that LRA Section B.2.32 is revised to address the 10 elements of an acceptable RVIs AMP described in GALL Report Revision 2 AMP XI.M16A. The applicant stated that the GALL Report consistency statement is revised to identify the PWR Reactor Vessel Internals Program as a new Davis-Besse program that will be consistent with the 10 elements in GALL Report Revision 2 AMP XI.M16A. The staff determined that the LRA Section B.2.32 revision to address the 10 elements in GALL Report Revision 2 AMP XI.M16A is acceptable for satisfying this information item. The staff's review of the applicant's 10 program elements, as described in LRA Amendment 15, Section B.2.32 relative to the 10 elements in GALL Report Revision 2 AMP XI.M16A, is discussed below.

(2) Regarding item No. (2) from Section 3.5.1 of the final SE, the applicant stated that LRA Sections B.2.32 and A.1.32 are revised to state that a plant-specific inspection plan for ensuring the implementation of MRP-227 guidelines, as amended by the final SE, and the applicant's responses to the plant-specific action items, as identified in Section 4.2 of the final SE, will be submitted for NRC review and approval. The applicant also stated that a specific commitment is provided in the USAR supplement commitment table, which requires the submittal of the inspection plan based on the approved version of MRP-227 and the applicant's responses to the plant-specific action items identified in Section 4.2 of the final SE. The applicant also stated that this commitment requires the submittal to be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff reviewed the applicant's USAR supplement commitment table, and confirmed that Commitment No. 15, as revised by LRA Amendment 15, specifies that the inspection plan for ensuring the implementation of MRP-227 guidelines, as amended by the final SE, and the applicant's responses to the plant-specific action items, as identified in Section 4.2 of the final SE, will be submitted for NRC review and approval. The staff confirmed that the implementation schedule for this commitment specifies that the inspection plan submittal will be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff determined this commitment is acceptable for satisfying this information item because the applicant's original LRA submittal (August 27, 2010) precedes the final SE and GALL Report Revision 2, and the implementation schedule for this commitment is consistent with the inspection plan submittal schedule specified in NRC RIS 2011-07, "License Renewal Submittal Information for Pressurized Water Reactor Internals Aging Management," July 21, 2011.

(3) Regarding item No. (3) from Section 3.5.1 of the final SE, the applicant stated that LRA Sections B.2.32 and A.1.32 are revised to state that the Davis-Besse PWR Reactor Vessel Internals Program will address all plant-specific action items applicable to Davis-Besse that are established in Section 4.2 of the final SE, in addition to the

programs and activities specified in the staff-approved version of MRP-227. The staff determined that these revisions to LRA Sections B.2.32 and A.1.32 are appropriate because information item No. (3) from Section 3.5.1 of the final SE specifies that applicants referencing the staff approved version of MRP-227 as the basis for their RVIs AMPs shall ensure that the programs and activities, as specified in the staff-approved version of MRP-227, are summarily described in the LRA USAR supplement. The staff's review of the applicant's amended USAR supplement section for this AMP, relative to this information requirement and SRP-LR Table 3.1-2, is discussed in the following "USAR Supplement" section.

(4) Regarding item No. (4) from Section 3.5.1 of the final SE, the applicant stated that LRA Sections B.2.32 and A.1.32 are revised to state that the MRP-227 inspection and evaluation guidelines require a visual (VT-3) examination of the core support shield (CSS) vent valve retaining rings and disc shaft for every 10-year ISI interval. The applicant also stated that LRA Sections B.2.32 and A.1.32 are revised to identify the Davis-Besse TS 5.5.4 requirements for inspection and testing of the CSS vent valves every 24 months to (1) verify by visual inspection that the valve body and valve disc exhibit no abnormal degradation, (2) verify the valve is not stuck in an open position, and (3) verify by manual actuation that the valve is fully open when a force less than or equal to 400 lbs is applied vertically upward. The applicant stated that the TS-required vent valve testing and inspection will continue to be performed at the prescribed frequency of 24 months. The applicant also stated that the MRP-227 required visual (VT-3) examination of the CSS vent valve retaining rings and disc shaft will also be performed at the MRP-227 prescribed frequency of once every 10-year ISI interval. The staff determined that these revisions to LRA Sections B.2.32 and A.1.32 are appropriate for addressing information item No. (4) from Section 3.5.1 of the final SE, because the LRA revisions, as described in the RAI response, address the mandated TS requirements in addition to the separate MRP-227 guidelines for inspection of the CSS vent valves. The staff reviewed the applicant's program elements below to determine whether the two distinct sets of CSS vent valve inspection criteria are clearly identified.

(5) Regarding item No. (5) from Section 3.5.1 of the final SE, the applicant stated that LRA Sections B.2.32 and A.1.32 are revised to state that the program includes management of the TLAA for reduction in fracture toughness of the RVIs. This TLAA will be managed in accordance with the implementation of the MRP-227 guidelines, as amended by the MRP-227 final SE, including all activities associated with the responses to plant-specific action items identified in Section 4.2 of the final SE. The staff determined that the applicant's general program description (discussed above), as revised by LRA Amendment 15, adequately addresses the management of this time-limited aging effect, and as documented in the Davis-Besse LRA SER, Section 4.2.7, the applicant has identified and evaluated a TLAA for the reduction in fracture toughness of the RVIs. Therefore, the staff found that information item No. (5) from Section 3.5.1 of the final SE is satisfied because the applicant has addressed the TLAA of the reduction in fracture toughness for the RVIs, as required by this information item.

As discussed above, the staff determined that the applicant's response to RAI B.2.32-1 adequately addressed three of the five plant-specific AMP information requirements from Section 3.5.1 of the staff's final SE for MRP-227. Item No. (2), which requires the submittal of a detailed plant-specific RVI inspection plan, is not complete but is addressed by LRA Commitment No. 15. Once the detailed RVI inspection plan is approved by the staff, applicant action item No. 8 will be considered complete for Davis-Besse. However, if the applicant's submitted RVI inspection plan is not approved by the staff, action item No. 8 will be completed through the staff's proposed license condition No. 5 presented in SER Section 1.7 and discussed in the "License Condition" subsection of this AMP.

As discussed above, by letter dated December 16, 2011 the staff issued Revision 1 of its final SE for MRP-227. The MRP-227 document was revised based on the conditions and limitations identified in Section 4.1 of Revision 1 of the final SE, and it was reissued as MRP-227-A by letter dated January 9, 2012. MRP-227-A includes Revision 1 of the staff's SE as an attachment. MRP-227-A represents the final staff-approved version of the MRP-227 guidelines. The staff noted that for B&W plants, the MRP-227-A document now requires that certain components with a high consequence of failure, subject to multiple degradation mechanisms, be included in the "Primary" inspection category, whereas in MRP-227, Revision 0, these components were included in the "Expansion" inspection category. Additionally, MRP-227-A includes revisions to inspection coverage and frequencies for certain "Primary" and "Expansion" category components. Based on the specific changes to the inspection guidelines, as implemented in MRP-227-A, the staff determined that the applicant should reconcile its program for aging management of the RVI components, including its AMR results for the RVI components, with the staff-approved guidelines in MRP-227-A and Revision 1 of the staff's SE for MRP-227 (i.e., the MRP-227-A SE). Therefore, in a conference call held on January 24, 2012, the staff requested that the applicant address, in a supplemental response-, whether the Davis-Besse PWR Reactor Vessel Internals Program, as described in LRA Amendment 15, Section B.2.32, would need to be revised based on the PWR internals inspection guidelines published in MRP-227-A and the MRP-227-A SE.

By letter dated March 9, 2012, the applicant provided a supplemental response to RAI 3.1.2.2-2 that addressed the latest PWR internals inspection guidelines in MRP-227-A, including the staff's MRP-227-A SE, and the reconciliation of the Davis-Besse Reactor Vessel Internals Program and AMR results for the RVIs with the MRP-227-A guidelines,

The applicant stated that it performed a review of the latest guidelines in MRP-227-A, including Revision 1 of the staff's SE for MRP-227-A, dated December 2011, relative to the original RVIs inspection guidelines in MRP-227, Revision 0 and Revision 0 of the staff's SE for MRP-227, Revision 0, dated June 2011, and determined that some changes are necessary for the RVIs AMR Results line items identified in LRA Section 3.1.2, Table 3.1.2-2. In its supplemental response to RAI 3.1.2.2-2, the applicant provided a summary of the revisions to the LRA Table 3.1.2-2 RVIs AMR Results, which were included in LRA Amendment 24. LRA Amendment 24 was provided as an enclosure to the applicant's March 9, 2012 RAI response. A summary discussion of the LRA Table 3.1.2-2 revisions provided in LRA Amendment 24 and the staff's evaluation of these revisions relative to the MRP-227-A guidelines and Revision 1 of the MRP-227-A SE follows:

Row 4—control rod guide tube (CRGT) spacer casting changed from an expansion component with primary component link of core support shield (CSS) cast outlet nozzles, CSS vent valve discs or in-core monitoring instrumentation (IMI) guidetube spiders, to a primary component with no expansion components. The staff confirmed that this revised classification is consistent with Section 3.3.7 of Revision 1 of the MRP-227-A SE.

Row 10—CSS cast outlet nozzles changed from a primary component with expansion component link of CRGT spacer casting to a 'no additional measures' component. The staff confirmed that this revised classification is consistent with Table 3-1 of MRP-227-A.

Row 13—As discussed in Section 3.7 of the MRP-227-A SE, the CSS vent valve disc shaft was determined to be an active component and, therefore, not subject to aging management. Therefore, row 13 is changed to “Not used.” The staff agreed with this revision because Section 3.7 of the MRP-227-A SE identified the CSS vent valve disk shaft as being an active component; therefore, it is not subject to aging management under the MRP-227-A guidelines for B&W plants. This determination was based, in part, on existing TS requirements for inspections and actuation testing of the CSS vent valves on a 24 month cycle, as discussed above.

Rows 20 and 21—In addition to the aging effects of cracking due to irradiation-assisted stress corrosion cracking (IASCC) and reduction in fracture toughness, the aging effects of cracking due to fatigue, loss of material, and loss of preload were added for the core barrel-to-former (CBF) bolts and baffle-to-former (BF) bolts. The staff confirmed that these revised aging effects are consistent with Table 3-1 of MRP-227-A.

Row 22—In addition to the aging effects of cracking due to fatigue and reduction in fracture toughness, the aging effects of loss of material and loss of preload were added for the baffle-to-baffle (BB) bolts—internal. The staff confirmed that these revised aging effects are consistent with Table 3-1 of MRP-227-A.

Row 23—In addition to the aging effects of cracking due to fatigue, cracking due to IASCC and reduction in fracture toughness, the aging effects of loss of material and loss of preload were added for the baffle-to-baffle (BB) bolts—external. The staff confirmed that these revised aging effects are consistent with Table 3-1 of MRP-227-A.

Rows 42 and 43—Since the CRGT spacer casting was changed to a primary component (see Row 4 above), it is deleted as an expansion component for the IMI guide tube spiders and spider-to-lower grid rib section welds. The staff confirmed that this revised classification is consistent with Table 4-1 of MRP-227-A.

Plant-specific note 0114—This note previously addressed the classification of the flow distributor (FD) bolts and their locking devices. However, it is no longer needed for that purpose since Table 4-1 of MRP-227-A now shows the component as a primary component with expansion component links of upper thermal shield (UTS) bolts and their locking devices, lower thermal shield (LTS) bolts and their locking devices, and surveillance specimen holder tube (SSHT) bolts and their locking devices. The staff confirmed that this revised classification is consistent with Section 4.1.3 of the MRP-227-A SE. The staff also confirmed that the Plant-specific note 0114 is now appropriately used to provide clarification that components assigned to the “no additional measures” group were determined to be below the screening criteria for the applicable degradation mechanisms, or were classified under this category due to Failure Modes, Effects, and Criticality Analyses (FMECA) and functionality analysis findings. Therefore, no further action is required by MRP-227-A for aging management of these components.

Based on its revisions to the RVIs AMR Results items provided in LRA Amendment 24, Table 3.1.2-2, as discussed above, the applicant determined that several changes should be made to the Davis-Besse PWR Reactor Vessel Internals Program, as described in LRA Amendment 15, Sections B.2.32 and A.1.32, to ensure that the program is consistent with MRP-227-A and the MRP-227-A SE. These program changes, which are implemented in LRA Amendment 24, include the following:

(1) revisions to LRA Sections B.2.32 and A.1.32 to delete any discussion of aging management of the CSS vent valve disk shaft based on the fact that this is an active component, for which aging management is not required under the MRP-227-A guidelines;

(2) deletion of the discussion of the FD bolts classification and examination method, coverage, and frequency in program element four, “Detection of Aging Effects,” of LRA Section B.2.32, based on the fact that Table 4-1 of MRP-227-A now addresses the necessary inspection of these bolts, as required by Section 4.1.3 of the MRP-227-A SE; and

(3) revisions to LRA Section B.2.32 and A.1.32 to explicitly identify “MRP-227-A” instead of “MRP-227, Revision 0,” as the basis document for the Davis-Besse PWR Reactor Vessel Internals Program.

The staff confirmed that these program changes have been incorporated, as warranted, into the first six program elements, which are discussed below. The staff determined that these program changes are consistent with MRP-227-A and the staff’s SE for MRP-227-A. Therefore, the staff finds the above changes to the Davis-Besse PWR Reactor Vessel Internals Program acceptable.

The applicant stated that, based on its review of the MRP-227-A guidelines, including Revision 1 of the staff’s SE for MRP-227-A, dated December 2011, it was determined that no program revisions were necessary for addressing the AMP information requirements identified in Section 3.5.1 of Revision 1 of the staff’s SE for MRP-227-A. The staff agreed with this determination because the RVIs AMP information requirements identified in Section 3.5.1 of Revision 1 of the staff’s SE for MRP-227-A are unchanged relative to those identified in Revision 0 of the staff’s SE for MRP-227, Revision 0, dated June 2011.

Based on its evaluation of the applicant’s March 9, 2012 supplemental response to RAI 3.1.2.2-2, as discussed above, the staff determined that the applicant adequately reconciled its program for aging management of the RVIs and the RVIs AMR Results with the latest NRC staff-approved industry guidelines for aging management of PWR RVI components. The staff also determined that the applicant had implemented appropriate changes to the both the program and the AMR results for the Davis-Besse RVIs, and these changes ensure that aging management of the Davis-Besse RVIs will be consistent with the MRP-227-A guidelines during the period of extended operation. Accordingly, the staff’s concerns described in RAIs B.2.32-1 and 3.1.2.2-2 are resolved.

The staff reviewed program elements one through six of the applicant’s program, as described in LRA Amendments 15 and 24, Section B.2.32, against the corresponding program elements described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant’s program elements are consistent with the GALL Report Revision 2 AMP XI.M16A program elements. The staff’s evaluation of each of these elements follows.

Scope of the Program. LRA Amendments 15 and 24, Section B.2.32 states that the scope of the program includes all RVI components at Davis-Besse. The applicant also stated that the scope of the program applies the methodology and guidance of the most recently NRC-endorsed version of MRP-227 (MRP-227-A), which provides augmented inspection and flaw evaluation guidelines for assuring functional integrity of safety-related internals in PWR plants designed by Westinghouse, B&W, and Combustion Engineering. The applicant also stated that the scope of components considered for inspection under MRP-227 guidance includes the core support structures, those RVI components that serve an intended license renewal safety function, and other RVI components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii). The applicant stated that the scope of the program does not include welded attachments to the internal surface of the RV because these components are ASME Code Class 1 appurtenances to the RV and are adequately managed by the ISI AMP, which corresponds to GALL Report AMP XI.M1, "ASME Code, Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

Consistent with its response to RAI B.2.32-1, the applicant stated that the scope of this program, as described in LRA Amendment 15, includes the management of the TLAA identified in LRA Section 4.2.7 for reduction in fracture toughness of the RVIs. The applicant stated that this time-limited aging effect will be managed in accordance with the implementation of the MRP-227 guidelines, as amended by the MRP-227 final SE, including all activities associated with the applicant's responses to plant-specific action items identified in Section 4.2 of the final SE.

The applicant stated that the scope of the program includes the response bases to applicable license renewal applicant action items on the MRP-227 methodology, as identified in Section 4.2 of the final SE, and any additional activities that are discussed in the action item responses. The applicant also stated that Davis-Besse's responses to all plant-specific action items will be submitted for NRC review and approval.

The applicant stated that the guidance in Section 2.4 of MRP-227 specifies applicability limitations to base-loaded plants and the fuel loading management assumptions upon which the PWR internals functionality analyses were based. According to the applicant, general assumptions used in the functionality analysis include:

- 30 years of operation with high leakage core loading patterns followed by implementation of a low-leakage fuel management strategy for the remaining 30 years of operation
- base load operation
- no design changes beyond those identified in general industry guidance or recommended by the original vendors

According to the applicant, the core design for Davis-Besse is within the fuel loading management assumption of the MRP-227 functionality analysis. The applicant also stated that Davis-Besse is a base load plant and has incorporated no design changes beyond those identified in general industry guidance or recommended by the original vendors.

The staff reviewed the applicant's "scope of program" program element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant's program element is consistent with the corresponding "scope of program" program element in GALL Report Revision 2 AMP XI.M16A.

Based on its review of this element of the applicant's RVI program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is generally consistent with GALL Report Revision 2 AMP XI.M16A because the applicant's description of this program element generally corresponds to the "scope of program" program element defined in GALL Report Revision 2 AMP XI.M16A. Furthermore, this program element also addresses the management of the time-limited aging effect associated with the reduction in fracture toughness of the RVIs, which the applicant has evaluated as a TLAA in LRA Section 4.2.7. The staff determined that the applicant's identification of this aging effect as a TLAA satisfies AMP information item No. (5) from Section 3.5.1 of the final SE for MRP-227, as discussed above.

The staff noted that the “scope of program” program element in GALL Report Revision 2 AMP XI.M16A states that applicants’ responses to action items identified in the final SE are provided in Appendix C of the LRA. However, the applicant’s corresponding statement regarding the plant-specific action item responses specifies that Davis-Besse’s responses to the plant-specific action items will be submitted for NRC review and approval. Appendix C is not provided in the Davis-Besse LRA. The staff determined that since the original LRA submittal precedes the issuance of both the final SE and GALL Report Revision 2, the applicant is not required to provide detailed responses to the action items identified in the final SE as part of the LRA; therefore, this discrepancy is justified. Consistent with the inspection plan submittal schedule specified in RIS 2011-07, USAR supplement Commitment No. 15, as revised by LRA Amendment 15, specifies that the inspection plan for ensuring the implementation of MRP-227 guidelines, as amended by the final SE, and the applicant’s responses to the plant-specific action items, as identified in Section 4.2 of the final SE, will be submitted for NRC review and approval no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The applicant’s action item responses will include a detailed evaluation for assessing the plant’s design and operating history and demonstrating that the approved version of MRP-227 is applicable to the facility with respect to MRP-227 assumptions regarding plant design and operating history that were used in the failure modes, effects, and criticality analyses, and the functionality analyses, upon which the MRP-227 guidelines are based. Based on these inspection plan submittal schedule criteria, and the fact that the inspection plan is required to address the applicant’s detailed action item responses, the staff determined that the subject discrepancy between the applicant’s “scope of program” program element and the “scope of program” program element identified in GALL Report Revision 2 AMP XI.M16A is justified and does not represent an exception to the GALL Revision 2 AMP XI.M16A.

Based on the above, the staff confirmed that the applicant’s “scope of program” program element, as described in LRA Amendment 15, Section B.2.32 is consistent with the “scope of program” program element described in GALL Report Revision 2 AMP XI.M16A, and, therefore, the staff finds it acceptable.

Preventive Actions. LRA Amendment 15, Section B.2.32 states that the guidance in MRP-227 relies on PWR water chemistry control to prevent or mitigate aging effects that can be induced by corrosive aging mechanisms (e.g., loss of material induced by general, pitting corrosion, crevice corrosion, or SCC or any of its forms, including SCC, PWSCC, and IASCC. Reactor coolant water chemistry is monitored and maintained in accordance with the PWR Water Chemistry Program. The PWR Water Chemistry Program is an existing Davis-Besse program that is consistent with the 10 elements of an effective AMP as described in GALL Report Revision 1 AMP XI.M2, “Water Chemistry.”

The staff reviewed the applicant’s “preventive actions” program element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant’s program element is consistent with the corresponding “preventive actions” program element in GALL Revision 2 AMP XI.M16A.

Based on its review of this element of the applicant’s RVI program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is consistent with the “preventive actions” program element defined in GALL Report Revision 2 AMP XI.M16A. Therefore, the staff finds that the applicants “preventive actions” program element, as described in LRA Amendment 15, Section B.2.32, is acceptable.

Parameters Monitored or Inspected. LRA Amendment 15, Section B.2.32 states that the program manages the age-related degradation effects and mechanisms that are applicable in general to the RVIs components at the facility, as described in the "scope of program" program element. For the management of cracking, the applicant stated that the program monitors for evidence of surface breaking linear discontinuities if a visual inspection technique is used for the examination method, or for relevant flaw presentation signals if a volumetric (UT) method is used as the NDE method. For the management of loss of material, the applicant stated that the program monitors for gross or abnormal surface conditions that may be indicative of loss of material occurring in the components. For the management of loss of preload, the applicant stated that the program monitors for gross surface conditions that may be indicative of loosening in applicable bolted, fastened, keyed, or pinned connections. The applicant further stated that the program does not directly monitor for loss of fracture toughness that is induced by thermal aging or neutron irradiation embrittlement, or by void swelling and irradiation growth. The applicant stated that instead, the impact of loss of fracture toughness on component integrity is indirectly managed by using visual or volumetric examination techniques to monitor for cracking in the components. In addition, the applicant stated that the applicable reduced fracture toughness properties will be used in the flaw evaluations if cracking is detected in the components and is extensive enough to warrant a supplemental flaw growth or flaw tolerance evaluation under the MRP-227 guidance or ASME Code, Section XI requirements. The applicant also stated that the program uses physical measurements to monitor for any dimensional changes due to void swelling, irradiation growth, distortion, or deflection.

The applicant stated that the program implements the parameters monitored and inspected criteria for B&W designed Primary Components in Table 4-1 of MRP-227. The applicant also stated that the program implements the parameters monitored and inspected criteria for B&W designed Expansion Components in Table 4-4 of MRP-227. According to the applicant, no existing generic industry programs are sufficiently specific to monitor the aging effects addressed by the MRP-227 guidelines for B&W plants. Accordingly, the applicant specified that no components for B&W plants were placed into the Existing Programs group. The applicant stated that no inspections, except for those specified in ASME Code Section XI, are required for components that are identified as requiring "No Additional Measures," in accordance with the analyses reported in MRP-227. The applicant stated that, as part of the Davis-Besse ISI Program, a visual VT-3 examination of the RV removable core support structure is conducted once per ISI interval in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-N-3.

The applicant stated that the MRP-227 inspections and evaluations (I&E) guidelines require a VT-3 examination of the CSS vent valve retaining rings and disc shaft for every 10-year ISI interval. The applicant also noted that Davis-Besse TS 5.5.4 requires testing of the CSS vent valves every 24 months to (1) verify by visual inspection that the valve body and valve disc exhibit no abnormal degradation, (2) verify the valve is not stuck in an open position, and (3) verify by manual actuation that the valve is fully open when a force less than or equal to 400 lbs is applied vertically upward. The applicant stated that the TS inspection will continue to be performed at the prescribed frequency of 24 months, and the MRP-227 required VT-3 examination will also be performed at the prescribed frequency of every 10-year ISI interval.

In accordance with LRA Amendment 24, the applicant revised its discussion of this program element to delete any discussion of aging management of the CSS vent valve disc shaft, based on the fact that the latest NRC staff-approved inspection guidelines in MRP-227-A no longer require inspections of the CSS vent valve disc shaft for B&W plants because this is an active component, which is tested in accordance with TS 5.5.4 requirements. As discussed previously, the staff determined that this revision is consistent with MRP-227-A and, therefore, acceptable.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant's program element is consistent with the corresponding element in GALL Report Revision 2 AMP XI.M16A.

Based on its review of this element of the applicant's RVI program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is consistent with the "parameters monitored or inspected" program element defined in GALL Report Revision 2 AMP XI.M16A. Furthermore, the staff also determined that the applicant's description of this program element adequately addressed AMP information requirement No. (4) from Section 3.5.1 of the staff's final SE for MRP-227 because the applicant clearly delineated the TS requirements for inspection and testing of CSS vent valves from the separate MRP-227 guidelines for examination of the CSS vent valve retaining ring and disc shaft. Therefore, the staff determined that the "parameters monitored or inspected" program element, as described in LRA Amendment 15, Section B.2.32, is acceptable.

Detection of Aging Effects. LRA Amendment 15, Section B.2.32 states that the detection of aging effects is covered in two places: (a) the guidance in Section 4 of MRP-227 provides an introductory discussion and justification of the examination methods selected for detecting the aging effects of interest; and (b) standards for examination methods, procedures, and personnel are provided in a companion document, MRP-228. The applicant stated that the methods include UT examination methods for detecting flaws in bolting, physical measurements for detecting changes in dimension, and various visual (VT-3, VT-1, and EVT-1) examinations for detecting effects ranging from general conditions to detection and sizing of surface-breaking discontinuities. The applicant also stated that surface examinations may also be used as an alternative to visual examinations for detection and sizing of surface-breaking discontinuities.

The applicant stated that cracking caused by SCC, IASCC, and fatigue is inspected by either VT-1 or EVT-1 examination (for internals other than bolting) or by UT examination (bolting). According to the applicant, the VT-3 visual methods may be applied for the detection of cracking only when the flaw tolerance of the component or affected assembly, as evaluated for reduced fracture toughness properties, is known and has been shown to be tolerant of easily detected large flaws, even under reduced fracture toughness conditions. Additionally, the applicant stated that VT-3 examinations are used to monitor and inspect for loss of material induced by wear and for general aging conditions, such as gross distortion caused by void swelling and irradiation growth or by gross effects of loss of preload caused by thermal and irradiation-enhanced stress relaxation and creep.

The applicant stated that the program adopts the recommended guidance in MRP-227 for defining the expansion criteria that need to be applied to inspections of primary components and existing requirement components and for expanding the examinations to include additional expansion components. Therefore, according to the applicant, inspections performed on the internal components are performed consistent with the inspection frequency and sampling bases for primary components and expansion components in MRP-227, which have been demonstrated to be in conformance with the inspection criteria, sampling basis criteria, and sample expansion criteria in Section A.1.2.3.4 of SRP-LR BTP RLSB-1.

The applicant stated that the program implements the parameters monitored and inspected criteria and bases for inspecting the relevant parameter conditions for B&W designed primary components in Table 4-1 of MRP-227 and for B&W designed expansion components in Table 4-4 of MRP-227.

The applicant stated that, in some cases (as defined in MRP-227), physical measurements are used as supplemental techniques to manage the gross effects of wear, loss of preload due to stress relaxation, or changes in dimension due to void swelling, deflection, or distortion. The applicant noted that physical measurement methods applied by this program address the criteria from Section 4.3.1 of MRP-227, which describe the physical measurements needed for the B&W internals core clamping items. The applicant also stated that the MRP-227 required examination method, examination coverage, and physical measurement acceptance criteria are implemented by this program.

The staff reviewed the applicant's "detection of aging effects" program element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant's program element is consistent with the corresponding element in GALL Report Revision 2 AMP XI.M16A.

Based on its review of this element of the applicant's RVI program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is consistent with the "detection of aging effects" program element defined in GALL Report Revision 2 AMP XI.M16A. Therefore, the staff determined that the "detection of aging effects" program element, as described in LRA Amendment 15, Section B.2.32, is acceptable.

Monitoring and Trending. LRA Amendment 15, Section B.2.32 states that the program requires that all inspections shall be documented for future review, and defects shall be documented in accordance with the Davis-Besse Corrective Action Program. The applicant stated that the program requires that a summary report of all inspections, monitoring activities, items requiring evaluation, and new repairs shall be submitted to the MRP Program Manager within 120 days of the completion of an outage during which the internals are examined.

The applicant stated that Section 6 of MRP-227 will not be used for evaluating examination results that do not meet the acceptance criteria identified in Section 5 of MRP-227. Rather, the applicant stated that it plans to use WCAP-17096-NP, "Reactor Internals Acceptance Criteria Methodology and Data Requirements," Revision 2, December 2009, as the framework to develop those generic and plant-specific evaluations triggered by findings in the internals examinations. The applicant noted that the staff is currently reviewing the evaluation guidance in WCAP-17096-NP, Revision 2.

The staff reviewed the applicant's "monitoring and trending" program element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant's program element is consistent with the corresponding element in GALL Report Revision 2 AMP XI.M16A.

GALL Report Revision 2 AMP XI.M16A states that the methods for monitoring, recording, evaluating, and trending the data that result from the program's inspections are given in Section 6 of MRP-227. However, the staff noted that, for this program element, the applicant stated that the WCAP-17096-NP, Revision 2 guidance will be used for developing criteria for evaluating component degradation in lieu of the MRP-227 Section 6 guidance on evaluating flaws or other relevant conditions. The staff determined that this discrepancy is acceptable and does not represent an exception to the GALL Report Revision 2 AMP because, as documented in the staff's SE for MRP-227, the general evaluation guidance in Section 6 of MRP-227 will be superseded by the more detailed evaluation guidance in WCAP-17096-NP, Revision 2 once the

WCAP-17096-NP, Revision 2 guidance is approved by the staff. As stated in WCAP-17096-NP, Revision 2, these evaluation methods were specifically developed to support the MRP-227 guidelines, and, as stated by the applicant in response to the staff's RAI on Section 6 of MRP-227 (MRP-227 NRC RAI 4-14), all plants referencing the MRP-227 guidance as the basis for their RVIs AMPs will be using the WCAP-17096-NP, Revision 2 evaluation methods in lieu of MRP-227, Section 6 guidance, once WCAP-17096-NP, Revision 2 is approved by the staff. The staff notes that applicants applying the WCAP-17096-NP methodology will be required to meet any conditions or applicant action items identified in the final SE related to WCAP-17096-NP, which should be included in the approved version of the topical report.

Based on its review of this element of the applicant's RV Internals Program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is consistent with the GALL Report Revision 2 AMP XI.M16A "monitoring and trending" program element because the applicant's description of this program element states that it will incorporate the more detailed WCAP-17096-NP, Revision 2 guidance for evaluation of component degradation, which meets the intent of the "monitoring and trending" program element, as defined in GALL Report Revision 2 AMP XI.M16A. Therefore, the staff determined that the "monitoring and trending" program element, as described in LRA Amendment 15, Section B.2.32, is acceptable.

Acceptance Criteria. LRA Amendment 15, Section B.2.32 states that Section 5 of MRP-227 provides specific examination acceptance criteria for the primary and expansion component examinations. For other components covered by existing programs, the applicant stated that the examination acceptance criteria are described within the existing program reference document.

The applicant described, in detail, the three types of examination acceptance criteria provided in MRP-227: visual examination acceptance criteria, volumetric examination acceptance criteria, and physical measurement acceptance criteria.

For this program element, the applicant noted that Section 6 of MRP-227 will not be used for evaluating examination results that do not meet the acceptance criteria identified in Section 5 of MRP-227. Rather, the applicant stated that it plans to use WCAP-17096-NP, Revision 2 as the framework to develop those generic and plant-specific evaluations triggered by findings in the RV internal examinations. As discussed in the SE for MRP-227, the staff is currently reviewing WCAP-17096-NP, Revision 2.

The staff reviewed the applicant's "acceptance criteria" program element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant's program element is consistent with the corresponding element in GALL Report Revision 2 AMP XI.M16A.

Based on its review of this element of the applicant's RV Internals Program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is consistent with the "acceptance criteria" program element defined in GALL Report Revision 2 AMP XI.M16A. Therefore, the staff determined that the "acceptance criteria" program element, as described in LRA Amendment 15, Section B.2.32, is acceptable.

Operating Experience. LRA Amendment 15, Section B.2.32 summarizes operating experience related to the PWR Reactor Vessel Internals Program. With respect to industry operating experience, the applicant noted that relatively few incidents of PWR internals aging degradation have been reported in operating U.S. commercial PWR plants, although a considerable amount of PWR internals aging degradation has been observed in European PWRs, with emphasis on cracking of baffle-former bolting. The applicant further stated that U.S. PWR owners and operators began a program a decade ago to inspect the baffle-former bolting in order to determine whether similar problems might be expected in U.S. plants. The applicant also discussed industry laboratory testing projects performed to gather the materials data necessary to support future inspections and evaluations. The applicant stated that cracking has been reported in some high-strength bolting and that this condition has been corrected primarily through bolt replacement with less susceptible material and improved control of pre-load.

With respect to plant-specific operating experience, the applicant stated that SCC has occurred in Alloy A-286 internals bolting in B&W units, which includes Davis-Besse. The applicant stated that Alloy A-286 bolt failures in B&W PWR internals were subjected to a comprehensive failure analysis that is documented in BAW-1843PA, "The B&W Owners Group Evaluation of Internal Bolting Concerns in 177FA Plants," dated January 1986, which was reviewed and approved by the NRC. The applicant further stated that this failure analysis addressed the probable cause of the cracking, assessment of likelihood and consequences of joint failure, and replacement bolt design. The applicant stated that the recommended replacement bolts were Alloy X-750 bolts subjected to a high temperature heat treatment process. According to the applicant, the Alloy X-750 high temperature heat treatment bolts are less susceptible to SCC and have overall excellent material properties.

The applicant stated that it has replaced the majority of the Alloy A-286 bolts for the RVIs (upper core barrel, lower core barrel, lower thermal shield, and surveillance specimen holder tubes) with Alloy X-750 high temperature heat treatment bolts. The applicant stated that it performed UT examinations of 100 percent of all upper core barrel bolts during the cycle 16 RFO. The applicant stated that this inspection did not identify any unacceptable indications. The applicant further stated that, as part of the ISI Program, a visual (VT-3) examination of the reactor's removable core support structure is conducted once every 10-year ISI interval in accordance with the ASME Code, Section XI, Table IWB 2500 1, Examination Category B-N-3. According to the applicant, these inspections have not identified any unacceptable indications.

The applicant also stated that, through its participation in the MRP-227 programs and activities for aging management of the RVIs, it will benefit from the industry-wide operating experience associated with the internals inspections, and it will share its own internals inspection results with the industry, as appropriate.

The staff reviewed the applicant's operating experience element against the corresponding program element described in GALL Report Revision 2 AMP XI.M16A to determine whether the applicant's program element is consistent with the corresponding element in GALL Report Revision 2 AMP XI.M16A. Based on its review of this element of the applicant's RVI program, as described in LRA Amendment 15, Section B.2.32, the staff determined that it is consistent with the operating experience element defined in GALL Report Revision 2 AMP XI.M16A. Based on its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its review of the application, the staff finds that the operating experience related to the applicant's program demonstrates that it will adequately manage the detrimental effects of aging on components within the scope of the program and that implementation of the program will result in the applicant taking appropriate corrective actions. This determination is based on the fact that the plant-specific operating experience regarding PWR internals aging degradation has been effectively addressed by the applicant, and industry operating experience has been addressed as part of the development of MRP-227. Furthermore the staff finds that the applicant will continue to effectively address both plant-specific and industry operating experience through its implementation of the staff-approved version of the MRP-227 guidelines because the applicant has fully committed to implementing the MRP-227 guidelines during the period of extended operation. The MRP-227 guidelines require the reporting of operating experience by participating plants, and they specifically address criteria for evaluating the accumulated additional operating experience. Therefore, the staff determined that the "operating experience" program element, as described in LRA Amendment 15, Section B.2.32, is acceptable.

The staff noted that MRP-175 Section A.1.4, "Materials Reliability Program: PWR Internal Aging Degradation Mechanism Screening Threshold Values," states that susceptibility of nickel-based Alloy X-750 PWR RVI components to SCC depends on the type of heat treatment that is performed on the alloy. High temperature heat treatment processes that are used on Alloy X-750 components offer better resistance to SCC than the other age hardened heat treatment processes. The type of heat treatment applied to Alloy X-750 PWR RVI components is a critical parameter for ensuring that the Davis-Besse PWR Reactor Vessel Internals Program will adequately manage the effects of aging due to SCC for the Alloy X-750 components. Therefore, by letter dated July 11, 2011, the staff issued RAI B.2.32-2, wherein the staff requested that the applicant provide information related to the type of heat treatment process that was used for the Alloy X-750 RVI components at Davis-Besse.

In its response dated September 16, 2011, the applicant described two types of RVI components fabricated from Alloy X-750: (1) Alloy X-750 replacement bolts and the associated X-750 compression collars, both of which are the high temperature heat treatment condition; and (2) Alloy X-750 dowels fabricated to the Aeronautical Material Specifications (AMS)-5667F specification. The applicant stated that the AMS-5667F heat treatment (also called the AH condition) requires (1) equalize heat treatment at 1625 ± 25 °F for 24 hours, followed by air cooling; and (2) precipitation heat treatment at 1300 ± 25 °F for 20 hours, followed by air cooling. The applicant provided additional discussion regarding the specific RVI components for which these materials are used, as well as the MRP-227-based inspection categorization (primary, expansion, and no additional measures) for the Alloy X-750 components, based on MRP-190, "Materials Reliability Program: Failure Modes, Effects, and Criticality Analysis of B&W-Designed PWR Internals."

The staff found the applicant's response to RAI B.2.32-2 acceptable because the applicant provided sufficient detail regarding the heat treatment processes used for the RVI components fabricated from Alloy X-750, as well as the application of the MRP-227 criteria for determining the inspection requirements for these components. Furthermore, the staff confirmed that the applicant correctly applied the MRP-227 criteria for categorizing the Alloy X-750 components, based on the components' susceptibility to the eight degradation mechanisms identified in the MRP-190 failure modes, effects, and criticality analysis (FMECA) for B&W plants, and that the materials and heat treatments for the bolts, compression collars, and dowels are consistent with the assumptions made in the development of MRP-227. The staff also determined that the applicant's discussion of its use of Alloy X-750 high temperature heat treatment for replacement bolting applications is consistent with its description of operating experience above, and the applicant's actions to replace the SCC-susceptible Alloy-286 bolting with less susceptible Alloy X-750 high temperature heat treatment bolting demonstrates that it is adequately addressing plant-specific and industry operating experience. The staff noted that the details regarding the application of the MRP-227 guidelines for categorizing RVI components based on the FMECA will be addressed in the plant-specific inspection plan. As discussed previously, USAR supplement Commitment No. 15 was revised per LRA Amendment 15 to require the submittal of the inspection plan no later than 2 years after issuance of the renewed operating license or 2 years prior to entering the period of extended operation, whichever is earlier. Therefore, the staff's concern described in RAI B.2.32-2 is resolved.

The staff noted that during the period of extended operation, CASS PWR RVI components are susceptible to a reduction in fracture toughness due to the combined effects of neutron embrittlement and thermal embrittlement. The synergistic effects of neutron embrittlement and thermal embrittlement may lead to the potential for failure of CASS RVI components under some design basis loading conditions. Therefore, by letter dated July 11, 2011, the staff issued RAI B.2.32-3, wherein the staff requested that the applicant explain how the Davis-Besse PWR Reactor Vessel Internals Program will account for the reduction in fracture toughness due to the synergistic effects of neutron embrittlement and thermal embrittlement when evaluating CASS components. The staff noted that CASS RVI components should be initially screened based on casting method, ferrite content, and molybdenum content to determine if the components are susceptible to thermal embrittlement, and components deemed susceptible to thermal embrittlement based on the above screening criteria should receive either supplemental examinations or a component-specific evaluation to ascertain susceptibility to reduction in fracture toughness due to the synergistic effects of neutron embrittlement and thermal embrittlement.

In its response dated September 16, 2011, the applicant stated that CASS RVI components were initially screened based on casting method, ferrite content, and molybdenum content to determine if the components are susceptible to thermal embrittlement. The applicant listed the CASS RVI components that were determined to be susceptible to thermal embrittlement and with projected neutron fluence exposure greater than 1×10^{17} n/cm^2 (E greater than 1.0 MeV) for 60 years of operation: the incore monitoring instrumentation (IMI) guide tube assembly spiders and the CRGT spacer castings. The applicant noted that, for B&W plants, applicant action item No. 7 in Section 4.2 of the NRC SE for MRP-227 requires the development of plant-specific analyses to demonstrate that these components will maintain their functionality during the period of extended operation. The applicant noted that the PWR Reactor Vessel Internals Program will address all applicable plant-specific action items that are established in Section 4.2 of the SE for MRP-227, and a commitment (Commitment No. 15) is provided to ensure that the responses to these action items will be submitted for NRC review and approval.

The staff found the applicant's response to RAI B.2.32-3 acceptable because the applicant adequately explained how the Davis-Besse PWR Reactor Vessel Internals Program will manage reduction in fracture toughness due to thermal and irradiation embrittlement for CASS RVI components, taking into consideration the MRP-227 guidelines as modified by the staff's SE. In particular, the staff noted that the SE for MRP-227 provides a plant-specific action item (applicant action item No. 7), which requires applicants for B&W plants to develop plant-specific analyses to demonstrate that B&W IMI guide tube assembly spiders and CRGT spacer castings will maintain their functionality during the period of extended operation. This action item states that these analyses should also consider the possible loss of fracture toughness in these components due to thermal and irradiation embrittlement. The staff noted that the applicant's response to RAI B.2.32-3 correctly identified this action item for addressing the plant-specific functionality analyses of the CASS IMI guide tube assembly spiders and CRGT spacer castings. Furthermore, the staff noted that Commitment No. 15 in the USAR supplement, as revised by LRA Amendment 15, requires that responses to all applicable plant-specific action items be submitted for NRC review and approval no later than 2 years after issuance of the renewed license or 2 years prior to entering the period of extended operation, whichever is earlier. Therefore, the staff's concern described in RAI B.2.32-3 is resolved.

License Condition. The staff finds that, through Commitment No. 15, the applicant's PWR Reactor Vessel Internals Program will implement I&E of the Davis-Besse RVI components that are consistent with those recommended for B&W-designed RVI components in the MRP-227-A report. The staff finds that, in accordance with Commitment No. 15, a submittal of the inspection plan before the period of extended operation will include the applicant's bases for resolving the Applicant/Licensee Action Items (A/LAIs) that were included in the staff's safety evaluation, Revision 1, on MRP-227 issued on December 16, 2011. The staff also finds that Commitment No. 15 is consistent with the staff's RIS 2011-07 (issued July 21, 2011), which was issued to facilitate a predictable and consistent method for reviewing the PWR RVI AMPs of commercial PWR LRAs and the AMPs and inspection plans for PWR plants that have received renewed operating licenses. At the time of its issuance RIS 2011-07 applied to Davis-Besse as a Category C plant that had an LRA under the staff review.

Since the applicant's submittal of its LRA on August 27, 2010, and subsequent issuance of the staff's RIS 2011-07 on July 21, 2011, the staff has developed and provided additional guidance related to implementation of an acceptable PWR RVI inspection plan. Specifically, on December 16, 2011, the staff issued Revision 1 of its safety evaluation on MRP-227, which provided eight A/LAIs and seven Topical Report Conditions. Subsequently on June 3, 2013, the staff issued its final LR-ISG-2011-07 on aging management of PWR vessel internals. LR-ISG-2011-07 provides changes to the GALL Report to address aging management of PWR vessel internals, including a revised GALL Report AMP XI.M16, "PWR Vessel Internals," and specific AMR items that describe aging management of RVI components.

With FENOC's Commitment No. 15 to submit its inspection plan prior to April 22, 2015, for NRC staff review and approval consistent with Revision 1 of the NRC's safety evaluation on MRP-227, the staff finds that there is reasonable assurance that the effects of aging on RVI will be adequately managed for the period of extended operation. However, from its recent review of inspection plans submitted by numerous PWR plants, including one with a design similar to that of Davis-Besse, the staff notes that neither analyses, nor templates for analyses, that are needed to address several of the A/LAIs have been developed on either a generic or a plant-specific basis. Thus the path to approval of these inspection plans has proven to be more difficult than expected when the staff issued RIS 2011-07. Therefore, the staff has concluded that imposition of the following license condition is necessary:

> Perform inspections and replacements in accordance with Section 4 of MRP-227-A, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)," including those for components named in Applicant/Licensee Action Items 4, 6, or 7 as described in the NRC Safety Evaluation, Revision 1, on MRP-227, unless a plant-specific inspection plan has been approved by the NRC staff.

The staff is imposing this license condition in order to clarify the actions to be taken by the applicant in case the applicant's submitted inspection plan is not approved by the staff.

USAR Supplement. LRA Amendments 15 and 24, Section A.1.32 provides the USAR supplement for the PWR Reactor Vessel Internals Program. The staff reviewed this USAR supplement description of the program and noted that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2. The staff also noted that the applicant committed (Commitment No. 14) to implement the new PWR Reactor Vessel Internals Program for managing aging of the RVI components, prior to entering the period of extended operation.

In addition, the staff noted that the applicant also committed (Commitment No. 15, as revised by LRA Amendment 15) to submit for NRC review and approval a plant-specific inspection plan for ensuring the implementation of MRP-227 program guidelines, as amended by the staff's final SE for MRP-227, including Davis-Besse's responses to the plant-specific action items identified in Section 4.2 of the final SE. The staff noted that the implementation schedule for this commitment specifies that the inspection plan will be submitted no later than 2 years after issuance of the renewed operating license or 2 years prior to entering the period of extended operation, whichever is earlier. The staff finds that the implementation schedule for this commitment is consistent with the inspection plan submittal schedule criteria specified in RIS 2011-07. Accordingly, the staff finds that Commitment No. 15 will ensure that the applicant meets the criteria specified in AMP information requirement No. (2) from Section 3.5.1 of the staff's final SE for MRP-227.

Finally, the staff noted that the applicant's USAR supplement section for this program, as amended, satisfies the AMP information requirement specified on item No. (3) from Section 3.5.1 of the final SE for MRP-227, which specifies that applicants referencing MRP-227, as approved by the staff, for their RVIs AMPs shall ensure that the programs and activities specified in MRP-227, as approved by the staff, are summarily described in the USAR supplement.

Based on the above evaluation, the staff finds that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's PWR Reactor Vessel Internals Program, as described in LRA Amendments 15 and 24, Section B.2.32, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed for the RVIs 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 conclusion is based on the staff's determination that:

- The applicant's program, as described in LRA Amendments 15 and 24, Section B.2.32, will be consistent with the 10 elements of an effective PWR Internals AMP defined in GALL Report Revision 2 AMP XI.M16A.
- The applicant's program will be based on the latest NRC-approved version of the I&E guidelines for PWR internals, as established in MRP-227-A.
- The applicant has effectively addressed the PWR internals AMP information requirements identified in Section 3.5.1 of the staff's final SE for MRP-227-A, as required by Applicant/Licensee Action Item 8 from Section 4.2 of the staff's final SE.

However, the staff will not consider any of the Applicant/Licensee Action Items from the staff's final SE of MRP-227-A, including Applicant/Licensee Action Item 8, completed until Davis-Besse submits its detailed RVI Inspection Plan as required by item No. 2 from Section 3.5.1 of the staff's final SE of MRP-227-A, in accordance with LRA Commitment No. 15. The staff also reviewed the USAR supplement for this program, as amended, and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.7 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program

Summary of Technical Information in the Application. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 17, 2011, describes the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program as a plant-specific condition monitoring program. The applicant stated that the program will consist of opportunistic inspections of the internal surfaces of aluminum, copper alloy, stainless steel, and steel components exposed to air, condensation, moist air, diesel exhaust, or lubricating oil, and the external surfaces of cooling coils. The LRA also states that the program will include inspections of non-metallic flexible elastomeric components both internally and externally. The LRA further states that the program will manage loss of material and cracking; hardening, loss of material due to wear, and loss of strength for non-metallic flexible elastomeric components; and reduction of heat transfer for cooling coils.

Staff Evaluation. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

Scope of the Program. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 17, 2011, states that the program will inspect the external surfaces of cooling coils and the internal surfaces of aluminum, copper alloy, stainless steel, and steel components exposed to air, condensation, moist air, diesel exhaust, or lubricating oil. The LRA also states that the program will include inspections of non-metallic flexible elastomeric components both internally and externally.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific SCs for which the program manages aging. The staff finds the applicant's "scope of program" program element acceptable because it includes specific information regarding the components and materials that will be managed by the program.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.41, as amended by letters dated May 24 and June 3, 2011, states the program is a condition monitoring program and does not include any actions to prevent or mitigate aging effects.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that condition monitoring programs do not rely on preventive actions; thus, this information need not be provided. The staff finds the applicant's "preventive actions" program element acceptable because the program is a condition monitoring program and does not require any preventive actions.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 17, 2011, states that the program will inspect parameters directly related to degradation of metallic components, including visual evidence of corrosion or fouling and wall thickness measurements, as applicable. Enhanced visual inspections will be used to detect cracking of metallic components. The LRA also states that flexible elastomeric components will be inspected for visual evidence of surface degradation, such as cracking or discoloration. The LRA further states that elastomeric components will be managed for hardening and loss of strength through manipulation or prodding.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s), and should detect the presence and extent of aging effects. The staff finds the applicant's "parameters monitored of inspected" program element acceptable because the applicant's chosen inspection parameters (i.e., evidence of corrosion, fouling, cracking, surface degradation, discoloration, and wall thickness measurements) are appropriate to detect the aging effects managed by the program (i.e., cracking, loss of material, hardening, loss of strength, and reduction of heat transfer).

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 17, 2011, states that baseline inspections will be conducted for each material and environment combination prior to entering the period of extended operation at locations that are likely to exhibit the aging effect of concern for the given environment. The LRA also states that subsequent inspections will be opportunistic and will be performed whenever the components are opened for any reason and the surfaces are available for inspection. For elastomeric components, visual examinations as well as physical manipulation or prodding will be performed on a sample of 10 percent of the available surface area, including known suspect locations. The LRA further states that at least one inspection will be performed for each material and environment combination within the 10-year period prior to entering the period of extended operation.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states the following:

- Detection of aging effects should occur before there is a loss of the SC intended function(s).
- 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.
- The program element describes "when," "where," and "how" program data are collected.
- The method or technique and frequency may be linked to plant-specific or industry-wide operating experience.
- The discussion of the inspection method or technique should provide justification, including codes and standards referenced, that the technique and frequency are adequate to detect the aging effects before a loss of intended function.
- When sampling is used to inspect a group of SCs, the applicant should provide the basis for the inspection population and sample size.

The SRP-LR also states that a program based solely on detecting SC failure should not be considered as an effective AMP for license renewal.

The staff noted that the LRA states that enhanced visual examinations will be conducted to manage cracking for susceptible stainless steel components, but it does not state to what standard the enhanced visual examinations will be conducted. By letter dated July 21, 2011, the staff issued RAI B.2.41-1 requesting that the applicant revise LRA Section B.2.41 to indicate the standard to which enhanced visual examinations will be conducted.

In its response dated August 17, 2011, the applicant stated that, when required by ASME Code, inspections are conducted in accordance with the applicable code requirements. The applicant stated that in the absence of applicable code requirements, visual inspections are performed of metallic and polymeric component surfaces using plant-specific procedures implemented by inspectors qualified through plant-specific programs. The applicant revised the LRA to include a table identifying the type of inspections that will be performed to detect the aging effects managed by the program. The table states that enhanced visual (EVT-1 or equivalent), surface (magnetic particle, liquid penetrant), or volumetric (RT or UT) examinations will be used to detect cracking. The staff finds the applicant's response acceptable because these examination techniques are capable of identifying the aging effects managed by this program and are consistent with the GALL Report recommendations for identifying the applicable aging effects. The staff's concern described in RAI B.2.41-1 is resolved.

The staff finds the applicant's "detection of aging effects" program element acceptable for the following reasons:

- The applicant's chosen inspection techniques (i.e., visual, enhanced visual, manipulation, and prodding) are capable of detecting the aging effects managed by the program (i.e., cracking, loss of material, hardening, loss of strength, and reduction of heat transfer) prior to loss of component intended function.
- The applicant will collect data during baseline and opportunistic inspections.
- Any evidence of degradation will be entered into the Corrective Action Program.

The staff confirmed that the "detection of aging effects" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 7, 2011, states that inspection findings will be documented and evaluated by engineering personnel such that the results can be trended and results that do not meet acceptance criteria will be evaluated and traced using the Corrective Action Program. The LRA also states that adjustments will be made to the program as necessary to ensure timely corrective and mitigative actions. The LRA further states that the program will include a periodic review of the maintenance and surveillance history to ensure opportunities have occurred for each material and environment combination during the period. The LRA states that the interval between these reviews will be established based on the results of the baseline inspections.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described and should provide predictability of the extent of degradation to ensure timely corrective or mitigative actions. The SRP-LR also states that this program element describes "how" the data collected are evaluated and may also include trending for a forward look. The SRP-LR further states that plant-specific or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency of inspections. The staff finds the "monitoring and trending" program element acceptable because the program includes (1) baseline inspections performed prior to the period of extended operation to characterize the material condition of the components, and (2) trending and review of inspection findings, and review of inspection findings to ensure each material and environment combination has been inspected in order to ensure that degradation is identified prior to loss of component intended function.

The staff confirmed that the “monitoring and trending” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 7, 2011, states that indications of degradation detected during the inspections will be evaluated and compared to predetermined acceptance criteria. The LRA states that engineering evaluation will be used to determine the acceptance criteria for the aging effects of concern such that the need for corrective actions is identified prior to loss of intended function. The LRA also states that aging effects may be indicated by any abnormal surface condition, cracks, discoloration, or buildup of foreign material. The LRA further states that for stainless steels, a clean shiny surface is expected and unacceptable inspection findings include evidence of cracking, loss of material, heat exchanger tube or fin fouling, hardening, or loss of strength that could lead to loss of intended function during the period of extended operation. In addition, the LRA states that any acceptance criteria that are not met will be evaluated under the Corrective Action Program.

The staff reviewed the applicant’s “acceptance criteria” program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria for the program and its basis should be described and that the program should include a methodology for analyzing the results against applicable acceptance criteria. The SRP-LR also states that the acceptance criteria could be specific numerical values or should consist of a discussion of the process for calculating specific values. The SRP-LR further states that qualitative inspections should be performed to the same predetermined criteria as quantitative inspections. The staff finds the “acceptance criteria” program element acceptable because the program includes appropriate acceptance criteria to identify aging in the materials being managed by the program, and any acceptance criteria not met will be evaluated under the Corrective Action Program.

The staff confirmed that the “acceptance criteria” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.41, as amended by letters dated May 24, June 3, and August 7, 2011, summarizes operating experience related to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The LRA states that the EDG air start system was modified in 2003 to include filter, air dryers, and moisture separators due to chronic rust and particulate accumulation in the air start compressor and filter components. A similar modification was also performed for the SBODG. The LRA states that an operating experience review did not identify any aging effects due to moisture in the air start components downstream of the air dryers after the modifications. The LRA also states that corrosion has been identified in station air system components where moisture accumulates and that proper operation of the drains was confirmed to remove the moisture. The LRA further states that industry and plant-specific operating experience will be considered in the development and implementation of the program and lessons learned will be incorporated as appropriate.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that operating experience of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

SRP-LR Section A.1.2.3.10 also states that the applicant should commit to a review of future plant-specific and industry operating experience for new programs to confirm their effectiveness. The staff noted that the applicant did not include a commitment to review future operating experience for new AMPs. By letter dated July 21, 2011, the staff issued RAI B.2.41-2 requesting that the applicant revise LRA Table A-1, "Davis-Besse License Renewal Commitments," to include a commitment to perform a future review of operation experience for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to confirm the effectiveness of this program or justify why such a review is not necessary.

In its response dated August 17, 2011, the applicant stated that, in response to RAI B.1.4-1 in a previous letter dated June 24, 2011, it committed (Commitment No. 43) to do the following:

> [E]nsure that the current station operating experience review process includes future reviews of plant-specific and industry operating experience to confirm the effectiveness of the license renewal aging management programs, to determine the need for programs to be enhanced, or indicate a need to develop new aging management programs.

The applicant also stated that a separate operating experience commitment for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is not necessary. The staff finds the applicant's response acceptable because the applicant committed to perform a future review of operating experience for this new program, as recommended by the SRP-LR. The staff's concern described in RAI B.2.41-2 is resolved.

Based on its review of the application and the applicant's response to RAI B.2.41-2, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program will result in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

<u>USAR Supplement</u>. LRA Section A.1.41, as amended by letters dated May 24, June 3, and August 17, 2011, provides the USAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff reviewed this USAR supplement description of the program and noted that it does not conform to the recommended description for this type of program, as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, 3.4-2, 3.5-2, and 3.6-2 because the USAR supplement does not include what type of inspections will be used to manage the aging effects and, therefore, does not adequately describe the basis for how the program will manage aging effects during the period of extended operation. By letter dated July 21, 2011, the staff issued RAI B.2.41-3 requesting that the applicant revise the USAR supplement associated with the Internal Surfaces in Miscellaneous Piping and Ducting Program to include the type of inspections that will be used to the manage the program's aging effects or justify why the revision is not necessary.

In its response dated August 17, 2011, the applicant revised the LRA to include a table identifying the type of inspections that will be performed to detect the aging effects managed by the program. The staff finds the applicant's response acceptable for the following reasons:

- The examination techniques identified in the table are capable of identifying the aging effects managed by this program.
- The examination techniques are consistent with the GALL Report recommendations for identifying the applicable aging effects.
- The revised USAR supplement includes the information recommended by the SRP-LR.

The staff's concern described in RAI B.2.41-3 is resolved.

The staff also noted that the applicant committed (Commitment No. 40) to implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, the staff concludes that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement, as amended, for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.8 Nuclear Safety-Related Protective Coatings Program

Summary of Technical Information in the Application. LRA Section B.2.42 describes the existing Nuclear Safety-Related Protective Coatings Program as plant-specific. The applicant stated that the program is a condition monitoring program that monitors the performance of Service Level 1 coatings inside containment through periodic coating examinations, condition assessments and remedial actions, including repair or testing. In addition, the program defines roles, responsibilities, controls, and deliverables for monitoring the condition of coatings in containment. The applicant stated that Service Level 1 coatings are subject to the guidance of ASTM D5163-91, "Standard Guide for Establishing Procedures to Monitor the Performance of Safety Related Coatings in an Operating Nuclear Power Plant," and ANSI N101.4 (1972), "Quality Assurance for Protective Coatings Applied to Nuclear Facilities." The applicant stated that the program provides reasonable assurance that potential aging effects will be adequately detected and mitigated such that Service Level 1 protective coatings are maintained during the period of extended operation.

The applicant also stated that the program follows guidance of EPRI 1003102, "Guidelines on Nuclear Safety Related Coatings," Revision 1. Furthermore, the program ensures that the design basis accident (DBA) analysis limits with regard to debris loading from failed coatings will not be exceeded for the ECCS suction strainers.

Staff Evaluation. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements, as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

Scope of Program. LRA Section B.2.42 states that the program monitors the performance of Service Level 1 coatings inside containment through periodic coating examinations, condition assessments, and remedial actions, including repair or testing. The applicant stated that the program consists of periodic visual inspections of the Service Level 1 coatings, looking for any visual defects, such as blistering, cracking, flaking, peeling, delamination, rusting, and physical damage. The program was established in accordance with the guidance provided in ASTM D5163-91. The qualification testing of Service Level 1 coatings used for new applications or used as maintenance coatings for repair and replacement activities inside containment is addressed in the applicant's revised response to NRC GL 98-04 for Davis-Besse. The applicant stated that the testing meets the applicable requirements contained in RG 1.54, "Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants," Revision 0.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which state that the scope of program should include the specific SCs of which the program manages the aging.

The staff finds acceptable the inclusion of Service Level 1 coating within the scope of the program because proper maintenance of protective coatings inside containment is essential to ensure operability of post-accident safety systems that rely on water recycled through the containment sump/drain system. During a conference call on July 27, 2011, the staff requested that the applicant clarify the revision of ASTM Standards used in this program by providing the year or revision associated with each ASTM Standard used. During the conference call, the applicant indicated that the program is primarily based on ASTM D5163-91. Furthermore, it was indicated that an amended version of the Nuclear Safety-Related Protective Coatings Program will be provided to the staff at a later date. In its letter dated August 17, 2011, the applicant amended its LRA Appendix B program description by providing the year or revision associated with each ASTM Standard used in this program.

The staff finds the applicant's amended program acceptable because the additional information provides an adequate description of the ASTM Standards used in the program. The staff's concern described in the request during the July 27, 2011, conference call is resolved.

Preventive Actions. LRA Section B.2.42 states that the Nuclear Safety-Related Protective Coatings Program is a condition monitoring program that does not include preventive actions. The applicant stated that no actions are taken as part of the Nuclear Safety-Related Protective Coatings Program to prevent aging effects or mitigate age-related degradation.

The staff reviewed the applicant's "preventive actions" program element against the criteria in the SRP-LR Section A.1.2.3.2, which states that for condition or performance monitoring programs, they do not rely on preventive actions; thus, this information need not be provided.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined by SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.42 states that the Nuclear Safety-Related Protective Coatings Program monitors Service Level 1 coatings in accordance with ASTM D5163-91, ASTM D 714-02, "Standard Test Method for Evaluating Degree of Blistering of Paints" and SSPC VIS-2, "Standard Method of Evaluating Degree of Rusting on Painted Surfaces." The parameters monitored include any visible defects, such as blistering, cracking, flaking, peeling, delamination, rusting, and physical damage. The applicant stated that the program procedure will be revised to clarify that visible defects (e.g., rusting and physical damage) are inspection attributes following the guidance of ASTM D5163-08, Subparagraph 10.2, which describes visible defects that may be found on coated surfaces. Furthermore, the coating condition assessment inspection form will be revised to list the same set of degradation parameters for inspection as the governing procedure.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s). The staff finds the use of ASTM D5163-91 acceptable since it provides guidelines that are acceptable to staff for establishing an Inservice Coatings Monitoring Program for Service Level 1 coating systems. As such, the staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.42 states that visual inspection is performed for evidence of degraded qualified coatings and identification of unqualified coatings applied to SCs during each RFO, in accordance with the guidance in ASTM D5163-91. The containment inspection includes visual inspection of accessible areas that are listed in the approved procedure along with location plan maps. The applicant stated that if conditions do not warrant a closer review, inspectors are not required to examine portions of the area, structures, or components that are inaccessible due to insulation, scaffold or permanent plant SSCs. The applicant indicated that evidence of coating failure that occur in accessible areas may warrant closer review of coating areas hidden from view by an obstruction. The location of areas of the containment vessel that have visual evidence of repair or touch-up is documented on the coating condition assessment inspection form. The applicant also stated that individuals who perform coating inspections maintain qualifications per RG 1.58, "Qualification of Nuclear Power Plant Inspection, Examination and Testing Personnel," and ANSI N45.2.6, "Qualifications of Inspection, Examination and Testing Personnel for Nuclear Power Plants." The applicant also stated that the program procedure will be revised to specify that the qualifications for inspection personnel, the inspection coordinator, and the inspection results evaluator will follow the guidance found in ASTM D5163-08.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that detection of aging effects should occur before there is loss of the SC intended function(s). The staff finds the frequency of coating inspections to be acceptable since inspecting every RFO would provide adequate assurance that there is proper maintenance of the protective coatings. The method of performing the coatings inspection is acceptable since the staff has found acceptable that visual inspections are performed and are able to detect for adverse coating conditions such as delamination, blistering, peeling, flaking, rusting, cracking, and physical damage. The staff finds acceptable the revision of the program procedure to qualify personnel to ASTM D 5163-08. The staff finds that ASTM D 5163-08 is an acceptable standard for the qualification of inspection personnel, the inspection coordinator, and the inspection results evaluator per the GALL Report and RG 1.54, Revision 1. As such, the staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.42 states that the program owner develops and manages the Nuclear Safety-Related Protective Coatings Program. The applicant stated that the program owner maintains the non-DBA qualified protective coatings inventory. Inspection results are reviewed and identified degradations are evaluated in accordance with the applicant's Corrective Action Program. The applicant further stated that degraded coating that is left in place in an area is documented on the coating condition assessment inspection form and evaluated by the program owner. The applicant indicated that the Nuclear Safety-Related Protective Coatings Program procedure will be revised to include prioritization of repair areas as either needing repair during the same outage or as postponed to future outages, but under surveillance in the interim period, following the guidance of ASTM D5163-91.

The staff reviewed the applicant's "monitoring and trending program" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and, thus, effect timely corrective or mitigative actions. The staff finds the method in which the applicant evaluates identified degradation as acceptable since repairs are made as appropriate, and degradation is evaluated in accordance with the plant's corrective action process. As such, the staff determined that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.42 states that the Nuclear Safety-Related Protective Coatings Program characterizes, documents, and tests defective or deficient coatings in accordance with ASTM D5163-91. The applicant stated that coated surfaces, as applicable, are characterized as exhibiting blisters, cracking, flaking, peeling, delamination, abrasion, and holidays.

The applicant provided the following degradation definitions:

- Abrasion—the wearing away of coating material in small shreds as a result of friction
- Blistering—the formation of bubbles in a cured, or nearly cured, coating film after exposure, generally in an aqueous environment
- Cracking—the formation of breaks in a coating film that extend through to the underlying surface
- Delamination—a separation of one coat from another coat within a coating system or from the substrate
- Flaking—the detachment of small pieces of the coating film
- Holiday—pinhole, skip, discontinuity, or void in a coating film that exposes the substrate
- Peeling—the separation of one or more coats or layers of a coating system from the substrate

The definitions provided by the applicant above are plant-specific definitions and not necessarily those used by NRC. The applicant stated that coating identified as acceptable is coating that is free of delamination, blistering, peeling, flaking, cracking, and other defects (see above). Coating not determined to be acceptable is documented using the applicant's Corrective Action Program. The program procedure will be revised to improve reporting requirements by following the guidance of ASTM D5163-91. This includes summary reports of findings and recommendations for future surveillance or repair and prioritization of repairs.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. One objective of the program is to ensure that the DBA analysis limits with regard to debris loading from failed coatings will not be exceeded for the ECCS suction strainers. After reviewing the applicant's "acceptance criteria" program element against the criteria in the SRP-LR, the staff finds the acceptance criteria acceptable because the applicant appropriately identified defective or deficient coatings in accordance with ASTM D5163-91 and ensured that it will be documented and summarized. The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.42 summarizes operating experience related to the Nuclear Safety-Related Protective Coatings Program. The applicant stated that the program monitors coatings inside containment by identifying degraded conditions, performing evaluations, and performing corrective actions to ensure that the DBA analysis limits for debris loading will not be exceeded for the ECCS suction strainers.

The applicant provided the following information regarding operating experience:

> In 2011, the Nuclear Safety-Related Protective Coatings Program documented inspection findings in the Corrective Action Program for the Cycle 16 refueling outage. General coating conditions in Containment remained good. Inspection findings were:
>
> - Blistering of containment vessel coating material in two locations adjacent to the polar crane access ladder at approximately the 660' elevation. The degraded material has been removed.
> - Peeling coating material on structural steel for the elevation 610'-0" hot leg platform. The degraded material has been removed.
> - Rusting of containment penetrations identified and previously evaluated. Rework of these penetrations is currently planned to be performed per order during the Cycle 18 refueling outage.
> - Peeling of epoxy top coat on bottom of northeast, upper OTSG [once through steam generator] 1-1 support. The degraded material was quantified and added to the Non-DBA Qualified Protective Coatings Inventory.
> - Flaking paint on hot leg platform brace adjacent to the OTSG. The degraded material was quantified and added to the Non-DBA Qualified Protective Coatings Inventory.
> - Peeled top coat material was found on a lower snubber mounting for OTSG 1-2. This was quantified and added to the Non-DBA Qualified Protective Coatings Inventory.
>
> Several areas of degradation which were noted during this outage had been identified previously and are currently planned to be reworked during the Cycle 18 refueling outage. The degraded material in those areas has been included in the Non-DBA Qualified Protective Coatings Inventory.
>
> In 2008, NRC Integrated Inspection Report 05000346/2008-03 described the implementation of the Davis-Besse actions documented in the February 28, 2008 response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized Water Reactors." The Davis-Besse resolution of Generic Letter 2004-02 included the

> installation of a significantly larger strainer within containment. The debris source term was also significantly reduced through removal of nearly all fibrous insulation and completely stripping and recoating the containment dome. Detailed analyses that used bounding limits for debris generation, transport and head loss effect were performed using the NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," and associated NRC Safety Evaluation Report (SER) methods, with permitted deviations. The NRC inspectors reviewed the engineering change packages (ECPs) associated with modifications installed, procedure changes and programmatic controls implemented, and changes for the Updated Safety Analysis Report (USAR) in response to Generic Letter 2004-02. No findings of significance were identified [The NRC has not yet completed its review of this item].

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that the operating experience of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation. The applicant's performance of visual inspections every RFO, in accordance with ASTM D 5163-91, along with an acceptable acceptance criteria will ensure that the program will be effective. The applicant appropriately identified aging degradation in a timely manner and performed corrective actions. Based on its review, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the effects of aging on systems SCs within the scope of the program and implementation of this program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

<u>USAR Supplement</u>. LRA Section A.1.42 provides the USAR supplement for the Nuclear Safety-Related Protective Coatings Program.

The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for this type of program, as described in the GALL Report. The staff also notes that the applicant committed (Commitment No. 45) to implement the Nuclear Safety-Related Protective Coatings Program prior to entering the period of extended of operation for managing aging of applicable components.

The staff determined that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its review of the applicant's Nuclear Safety-Related Protective Coatings Program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.9 Shield Building Monitoring Program

<u>Summary of Technical Information in the Application</u>. By letter dated April 5, 2012, the applicant submitted a new plant-specific AMP, titled the Shield Building Monitoring Program, to address

shield building laminar cracking. As part of its investigation of the laminar cracking, the applicant conducted a root cause analysis. As discussed in the root cause analysis, the applicant concluded that the laminar cracking was event driven, caused by water intrusion and subsequent freezing during a 1978 blizzard. Additional information on the laminar cracking root cause and the initial RAI can be found in the staff's root cause inspection report, "Davis-Besse Nuclear Power Station-Inspection to Evaluate the Root Cause Evaluation and Corrective Actions for Cracking in the Reinforced Concrete Shield Building of the Containment System 05000346/2012009 (DRS)," dated June 21, 2012, and the staff's evaluation of the Structures Monitoring Program in SER Section 3.0.3.2.15. In the SER with Open Items, this issue was tracked as OI 3.0.3.2.15-1.

LRA Section B.2.43 describes the new Shield Building Monitoring Program as plant-specific. In the April 5, 2012 submittal, the applicant stated that the new program is a prevention and condition monitoring program that supplements the inspections conducted as part of the Structures Monitoring Program. The applicant also stated that periodic visual inspections will be performed on rebar (when exposed) and core bore openings using plant-specific procedures implemented by inspectors qualified through plant-specific procedures. The applicant further explained that prior to the period of extended operation a new coating will be applied to the shield building exterior concrete to reduce water penetration. As a preventive action, this new exterior concrete sealant or coating will be inspected or tested for evidence of loss of effectiveness during the period of extended operation.

Staff Evaluation. The staff reviewed program elements one through six of the applicant's Shield Building Monitoring Program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects during the period of extended operation through the effective incorporation of these program elements. This review did not address the adequacy of the CLB, or the impacts of laminar cracking on the licensing basis. The adequacy of the CLB is ensured via ongoing processes outside of license renewal. Additional information on that review can be found in the staff's June 21, 2012, root cause inspection report referenced above and associated documents.

During its review, the staff asked several rounds of RAIs which caused the applicant to resubmit or revise the Shield Building Monitoring Program several times. Unless otherwise noted, the staff's evaluation relates to the final version of the AMP found in the applicant's November 20, 2012, RAI response letter. Earlier versions of the AMP and previous RAIs are only discussed as necessary to support the staff's conclusions. The RAIs and the responses are summarized briefly below, followed by the staff's evaluation of each of the program elements as found in the final version of the AMP and clarified in the RAI responses.

- RAI B.2.39-13 issued by letter dated December 27, 2011: This RAI requested details on the shield building degradation, the root cause, and the expected corrective actions and impacts on aging management.
- RAI B2.39-13 response provided by letter dated April 5, 2012: This was the initial response that outlined the applicant's aging management approach for the shield building and submitted the original AMP.
- RAIs B.2.43-1, 2, and 3, issued by letter dated July 11, 2012: RAI B.2.4.3-1 requested details about the proposed shield building protective coating, including if the coating was within the scope of license renewal, how the coating would be inspected, maintained and replaced, and how it would be demonstrated that the coating could effectively protect the

shield building from water penetration. RAI B.2.43-2 requested clarification about the crack monitoring portion of the program, including acceptance criteria, inspection frequency, and inspector qualifications. RAI B.2.43-3 requested information on the scope of the program and why additional structures were not included in the scope of the program.

- RAI B.2.43-1, 2, and 3, responses provided by letter dated August 16, 2012: The applicant provided information on the coating qualifications (RAI B.2.43-1 response), the crack inspection program (RAI B.2.43-2 response), and the scope of the program (RAI B.2.43-3 response). The response letter also included LRA Amendment 31 which revised the Shield Building Monitoring Program replacing the previous program in its entirety.
- Followup RAIs B.2.43-1, 2, and 3, issued by letter dated October 26, 2012: Followup RAI B.2.43-1 requested additional qualification information for the protective coating and clarifications to the information contained in the USAR supplement. Followup RAI B.2.43-2 requested justification for the proposed bore sample size and the lack of impulse response testing during the period of extended operation. Followup RAI B.2.43-3 requested additional information on the scope of the program.
- Followup RAI B.2.43-1, 2, and 3, responses provided by letter dated November 20, 2012: The applicant provided the coating qualification information and updated the USAR supplement (Followup RAI B.2.43-1 response). The applicant also increased the sample size of the core bore inspections (Followup RAI B.2.43-2) and provided additional information on the justification for the scope of the program (Followup RAI B.2.43-3 response). The response letter also included LRA Amendment 36 which revised the Shield Building Monitoring Program to reflect the changes in sample size.
- RAIs B.2.43-2a and 3a, issued by letter dated January 4, 2013: RAI B.2.43-2a and 3a requested additional information to support the core bore sample size and scope of the program respectively. During telephone conference calls held on January 16, and 23, 2013, the staff clarified the intent of the RAIs was to request additional information on how laboratory testing confirmed assumptions made in the structural adequacy calculations, why other structures were not susceptible to laminar cracking, and to clarify inconsistencies in the wording of license renewal Commitment No. 20.
- RAI B.2.43-2a and 3a, responses provided by letter dated February 12, 2013: The applicant provided information on the testing (RAI B.2.43-2a response), discussed why other structures were not susceptible to laminar cracking (RAI B.2.43-3a response) and provided LRA Amendment 38 which revised and clarified the wording in Commitment No. 20.

The staff finds the November 20, 2012 AMP acceptable (detailed evaluation provided below). The applicant has addressed all of the staff's concerns for all RAIs, even if that is not explicitly stated for each RAI, and OI 3.0.3.2.15-1 is closed.

Scope of the Program. LRA Section B.2.43 states that the program includes the shield building reinforced concrete and rebar and the exterior concrete coatings on the shield building wall, the shield building dome and the shield building emergency air lock enclosure walls. The program will include periodic inspections or testing to ensure the existing environmental conditions are not causing degradation.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific structures and components managed by the program.

The staff noted that the program element did not identify the coating that would be used or how the coating would be qualified to resist water intrusion during a storm similar to the 1978 blizzard. To address this concern, by letter dated July 11, 2012, the staff issued RAI B.2.43-1. By letter dated August 16, 2012, the applicant responded and identified the coating that would be used on the walls of the shield building and stated that the coating was qualified per ASTM Standard D6904-03, "Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied to Masonry."

The staff reviewed the applicant's response and found portions of it acceptable. The response clearly stated that the concrete coating would be applied prior to the period of extended operation and would be within the scope of the Shield Building Monitoring Program. The response also identified the coatings being applied and provided information demonstrating the wall coating is qualified to resist the types of weather conditions present during the 1978 blizzard. However, the applicant did not provide qualification information for the identified dome coating. Therefore, by letter dated October 26, 2012, the staff issued followup RAI B.2.43-1 requesting the applicant provide qualification information for the shield building dome. By letter dated November 20, 2012, the applicant responded to part (3) of followup RAI B.2.43-1 and stated that the dome coating system has a vapor permeability of 0.55 perms and has been qualified per ASTM Standard D7311-07, "Standard Specification for Liquid-Applied, Single-Pack, Moisture-Triggered, Aliphatic Polyurethane Roofing Membrane." The staff reviewed the applicant's response and the referenced ASTM and noted that both the dome and wall coatings are qualified to resist the types of weather conditions present during the 1978 blizzard. The applicant identified the coatings, provided the coating qualifications, and clearly stated that the coatings were within the scope of the Shield Building Monitoring Program. Since the coatings are capable of protecting the concrete, and the existing laminar cracks, from future water intrusion, and the coatings are within the scope of the Shield Building Monitoring Program and will be adequately inspected during the period of extended operation, the staff's concerns identified in RAI B.2.43-1 and followup RAI B.2.43-1, related to the adequacy of the shield building coating and its inclusion in the scope of the program, are resolved.

The staff reviewed the applicant's original AMP submittal and noted that the scope of the program was limited to the shield building; however, the identified root cause included contributing causes related to weather events that affected all structures onsite. It was unclear to the staff how the applicant had concluded that the laminar cracking was unique to the shield building and why no additional structures required aging management. To address this concern, by letter dated July 11, 2012, the staff issued RAI B.2.43-3 requesting the applicant explain how it was concluded that the laminar cracking had not affected any other structures and how the degradation mechanism would be prevented or monitored during the period of extended operation. By letter dated August 16, 2012, the applicant responded to RAI B.2.43-3 and stated that the following four conditions were required to cause the laminar cracks: (1) significant moisture intrusion; (2) low temperatures; (3) the unique shield building flute-shoulder configuration; and (4) an unsealed concrete surface. The applicant also stated that the shield building is the only building within the scope of license renewal that has all four of the required conditions to initiate the laminar cracking. To confirm this, the applicant took core bores and conducted impulse response testing of an auxiliary building wall. No indications of laminar cracking were found. The applicant further stated that the scope of the program does not need to include any structures outside of the shield building because the design features of all other concrete structures prevent the occurrence of similar laminar cracking.

The staff reviewed the applicant's response and found it unacceptable. The response states that the flute shoulder configuration was a necessary condition for the laminar cracking; however, cracking was also identified around the main steam line penetrations and in the top 20 ft of the shield building, outside of the flute shoulders. Since cracking was identified outside of the flute shoulders, in areas that are not necessarily unique to the shield building in regards to design, it appears that other structures may be susceptible to similar laminar cracking. Also, the response does not explain why the auxiliary building wall was chosen to verify cracking has not occurred in other structures, nor does it explain why inspections of one wall are adequate to verify that laminar cracking has not occurred in any other structures within the scope of license renewal. To address these concerns, by letter dated October 26, 2012, the staff issued followup RAI B.2.43-3 requesting the applicant explain why no other structures are susceptible to laminar cracking when shield building cracking was identified outside the shoulder region, why the auxiliary building wall was chosen for additional testing, and why inspection of one additional wall is adequate to verify cracking has not occurred in other structures.

By letter dated November 20, 2012, the applicant responded to followup RAI B.2.43-3 and stated that the flute shoulders in the shield building established an inherent stress concentration in each shoulder section. This inherent stress allowed the stress from the freezing moisture to exceed the concrete tensile strength and initiate a crack. The applicant determined that cracking in the areas outside of the shoulders was a direct result of cracks propagating from the shoulder regions. The applicant stated that the density of rebar in the areas of the main steam line penetrations and within the top 20 ft of the building allowed the cracking from adjacent shoulders to propagate into those areas. The applicant stated that no other site structure has similar shoulder configurations which would lead to crack-initiation or propagation conditions, and; therefore, no other structures are susceptible to similar laminar cracking. The applicant also stated that the particular auxiliary building wall was chosen for investigation because it has been subjected to the prevalent wind forces and is not shielded by other buildings, the wall has a high density of rebar comparable to what is present in the shield building upper 20 ft, and the wall has a spray-on waterproof sealant. The applicant explained that the lack of laminar cracking in this area confirmed that both the shoulder configuration and lack of waterproof coating are necessary to initiate laminar cracking. Based on the above, the applicant concluded that no additional testing is necessary and no additional structures need to be included within the scope of the Shield Building Monitoring Program.

The staff reviewed the applicant's RAI response and found portions of it acceptable. The applicant explained that all of the laminar cracking originated in the flute shoulder regions and propagated from there based on rebar density. The staff reviewed the core bore impulse response testing results and verified that this was a reasonable explanation (additional discussion can be found in the staff's June 21, 2012, root cause inspection report). The staff noted that the RAI response explains the shield building is the only site structure with the inherent stresses due to the geometric configuration of the flute-shoulders. The staff also noted that the auxiliary building was a reasonable "worst-case" representation of the other structures onsite because it is exposed to generally the worst wind conditions (prevalent wind direction onsite) and it has a rebar density similar to the shield building. However, the staff did not understand why a wall with a waterproof sealant was the only wall investigated. Although the root cause indicated water intrusion was only one of the four necessary conditions to initiate cracking, the staff believes it is necessary to verify this by testing a representative 'worst-case' wall with no waterproof coating. To address this concern, the staff issued RAI B.2.43-3a by letter dated January 4, 2013, requesting the applicant provide additional information on why other structures within the scope of license renewal are not susceptible to cracking, specifically uncoated structures. The staff further discussed this concern with the applicant in telephone conference calls dated January 16 and 23, 2013.

In its response dated February 12, 2013, the applicant reiterated the point that all four conditions were required for the laminar cracking to occur; the shield building is the only structure that has the inherent stress concentrations (created by the flute shoulders) necessary to initiate laminar cracking. The applicant stated that a review of other site structures within the scope of license renewal identified other uncoated structures; however, the uncoated surfaces are flat walls, slabs, or cylindrical foundation piers and none of the structures have the design configuration necessary to initiate laminar cracking. In addition, the applicant explained that additional testing of an uncoated structure was unnecessary because the cylindrical portion of the shield building effectively acted as a separate, uncoated structure exposed to the worst weather conditions. Testing of the entire accessible surface of the shield building did not identify any cracking that originated in the shell portion of the shield building.

The staff reviewed the applicant's response and noted that the applicant had reviewed all of the structures within the scope of license renewal and verified that they were either coated or lacked a design configuration geometry that could create a stress concentration necessary to initiate laminar cracking. The staff also noted that the applicant had effectively tested an uncoated structure by completing impulse response testing of the accessible portions of the shield building. The shell portion of the shield building did not show any indications of laminar cracking initiation. The staff find's the applicant's responses acceptable because the applicant verified no uncoated structures within the scope of license renewal have the necessary attributes to initiate laminar cracking. The applicant also conducted the appropriate impulse response testing to verify this conclusion. The staff's concerns identified in RAI B.2.43-3, followup RAI B.2.43-3, and RAI B.2.43-3a, related to the appropriateness of including only the shield building within the scope of the program, are resolved.

Based on its review of the RAI responses, and the program as submitted by letter dated November 20, 2012, the staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.43 states that the shield building exterior coatings will be inspected at a five year interval and reapplied at a 15-year interval. The inspections will be conducted by inspectors qualified as described in Chapter 7 of ACI Report 349.3R.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that the activities to prevent or mitigate aging should be described. The staff noted that the applicant did not originally identify when the coating would be applied or how it would be demonstrated that the coating was adequate to prevent moisture intrusion. This issue was addressed in RAI B.2.43-1 and the associated followup RAIs, and its review is discussed above in the "scope of program" element review. As noted above, the applicant provided qualification information for the coating and stated that it would be applied prior to the period of extended operation.

Based on its review, the staff finds that the preventive actions are acceptable because an adequate concrete coating will be applied to the shield building prior to the period of extended operation, and this coating will be inspected by personnel meeting qualifications commensurate with ACI 34.3R, an appropriate industry guidance document per the GALL Report, on a frequency that aligns with the GALL Report recommended guidance. The coating will be reapplied based on the manufacturer's guidance; not to exceed 15 years.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.43 states that parameters to be inspected will include visual evidence of surface degradation, such as cracking, loss of material and corrosion. The exterior concrete coatings will be inspected for loss of effectiveness by inspectors qualified as described in Chapter 7 of ACI Report 349.3R. The surface condition of core bores and core bore samples, along with changes in crack condition, will also be monitored.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that this element should identify the aging effects that the program manages and should provide a link between the parameters that will be monitored and how the monitoring will ensure adequate aging management. The SRP-LR also states that for a condition monitoring program, the parameters monitored should be capable of detecting the presence and extent of aging effects.

The staff noted that the AMP proposes to monitor the condition of the external coatings via visual inspections. The staff finds this acceptable because visual inspections are capable of detecting coating degradation and the effectiveness of the coating can be determined by assessing its condition. In addition this is the recommended method in the GALL Report. The staff further noted that the AMP proposes to monitor changes in laminar crack condition via visual examinations of the inner surfaces of core bore openings. Visual inspection is an effective method for identifying changes in concrete cracking and it is the method recommended in the GALL Report. However, since the laminar cracking is not visible from the surface of the structure, it can only be monitored visually via core bores. It was not clear to the staff that an appropriate number of core bores were being inspected to provide adequate aging management. This concern regarding the adequacy of the core bore sample size is discussed below in the "detection of aging effects" program element review. Since changes in laminar cracking cannot be identified via surface visual inspections, by letter dated October 26, 2012, the staff issued followup RAI B.2.43-2, requesting the applicant discuss its plans for conducting impulse response testing during the period of extended operation, or explain why impulse response testing is unnecessary.

In its response, dated November 20, 2012, the applicant explained that no impulse response testing was planned for the period of extended operation. The applicant stated that additional impulse response or other NDEs are unnecessary because the impulse response testing already completed, along with the existing core examinations provided a comprehensive condition assessment that confirmed the determinations of the root cause report. The applicant further explained that impulse response testing cannot measure the width of cracking; therefore, visual inspection of core bores along with a crack comparator is the necessary definitive method for monitoring changes in the shield building cracking. Impulse response testing was used to identify the extent of cracking; moving forward visual examinations of core bores will identify any changes in the cracking.

The staff reviewed the applicant's response and noted that impulse response testing cannot identify changes in the width of the cracking; the only way to detect changes is through the use of visual inspection of core bores and the use of a crack comparator. Since the applicant is using visual inspections to detect changes, the staff finds it acceptable that impulse response testing will not be repeated during the period of extended operation. The staff's concern related to the adequacy of visual examinations, and the portions of followup RAI B.2.43-2 associated with this issue, are resolved. RAI B.2.43-2, and the associated followup RAIs, also addresses the acceptability of the number of cores inspected and the frequency of inspections. These portions of the RAIs are discussed in the following sections.

Based on its review of followup RAI B.2.43-2, and the program as submitted by letter dated November 20, 2012, the staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3 and, therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.43 states that visual inspections will be performed on a representative sample of the shield building wall structural subcomponents by inspection of internal surfaces of core bores. The applicant further stated that the sample size consists of 20 core bore locations to include eight of the ten flute shoulders with a higher prevalence of event driven laminar cracking. The locations also include four bores above the 780 ft elevation (within the upper 20 ft of the structure where cracking was identified) and one at each main steam line penetration. The applicant further stated that the inspections would occur annually prior to the period of extended operation and would be changed to at least once every two years during the period of extended operation if no degradation was identified. During the period of extended operation the frequency can be changed to every five years if the two year frequency does not detect any degradation. Finally, the applicant noted that the coating inspections would occur at least once every five years.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that this element should address how the program would be capable of detecting or identifying the occurrence of age-related degradation prior to the loss of function. This element should also discuss "when" and "how" data will be collected for the program. This element should also justify the sample size of a sampling inspection program and should justify the inspection frequency and method.

The staff noted that the frequency begins with inspections every year and decreases over time, assuming the results of the inspections are acceptable, to a minimum frequency of once every five years. The staff finds this frequency acceptable because it starts out conservatively and decreases over time, based on positive inspection results, until it aligns with the GALL Report recommended inspection frequency for exterior concrete surfaces. As discussed above, the staff also finds the inspection method acceptable because visual inspection of core bores is the only definitive method for detecting changes in the laminar cracks.

The staff noted that the applicant proposed to monitor changes in laminar crack condition via examination of the inner surfaces of existing core bores. It was not clear to the staff how the applicant identified the location of the core bore examinations or justified the number of examination locations. Therefore, by letter dated October 26, 2012, the staff issued followup RAI B.2.43-2 requesting the applicant provide justification for the number of core bores being examined.

In its response, dated November 20, 2012, the applicant explained that the core bore distribution was chosen to focus on the areas where the event-driven laminar cracking was most prevalent; the flute shoulders, the main steam line penetrations, and the top 20 ft of the building. The applicant explained that 20 core bores will be inspected will cover eight of the ten shoulders with a high prevalence of cracking, shell sections of the building in the top 20 ft, and both main steam line penetrations. The inspections of the eight shoulders will include a combination of cracked and un-cracked core bores (14 total), while the shell section will include two “pairs” of cracked and un-cracked core bores (4 total). The final two core bores inspections will consist of one at each main steam line penetration area (2 total).

The staff reviewed the applicant’s response and found the location of the core bores acceptable because the cores covered the areas with the most prevalent cracking (i.e., the top 20 ft of the structure, the shoulders with the greatest exposure to wind-driven rain, and the main steam line penetration areas). However, the staff needed additional information on the assumptions made in the structural operability calculation regarding rebar-concrete bond strength and how the assumptions were validated. This information would help the staff understand the significance of the laminar cracking and help determine an adequate sample size for the core bore inspections that would identify the occurrence of age-related degradation prior to a loss of function. Therefore, by letter dated January 4, 2013, the staff issued RAI B.2.43-2a requesting the applicant explain the laboratory testing and the results, as well as how this information supported the original assumptions made in the structural operability calculations. The staff further discussed this issue with the applicant in conference calls dated January 16 and 23, 2013.

By letter dated February 12, 2013, the applicant provided its response to RAI B.2.43-2a. The staff reviewed the response and noted some typographical errors which the applicant corrected by letter dated February 28, 2013. In its response, the applicant stated that the original operability calculations demonstrated that the shield building remains capable of performing its safety functions despite the presence of laminar cracking. The applicant further stated that the calculations assumed there was no reinforcement capacity in cracked zones where the reinforcing bars included splices. During the calculations there was no way to quantify the reduction in rebar capacity so the rebar was considered ineffective. To validate this assumption, the applicant sponsored testing programs at Purdue University and the University of Kansas. The applicant explained that both programs evaluated the effects of laminar cracking using large scale rectangular beams constructed with similar materials and reinforcement as the shield building. In both studies beams were loaded to failure and in all cases the reinforcement developed stresses near or above the yield strength. The applicant further explained that the beams developed cracks wider than the cracks identified in the shield building. Based on the experiments, the professors involved in the testing concluded that the reinforcement in the shield building experiences little, if any, reduction in strength and capacity due to the laminar cracking condition. The applicant stated that the test findings provide additional confidence in the structural adequacy beyond that already documented in the operability calculations. The testing confirmed that the robust design and construction of the shield building allows the building to retain significant margin against design loads even with laminar cracking.

The staff reviewed the applicant’s response and noted that the original operability calculations conservatively assumed no reinforcement capacity in the cracked regions. Assuming the reinforcement had lost all capacity in the cracked regions was a conservative assumption, and the calculation still demonstrated the structure is safe and operable. To better understand the actual capacity of the reinforcement in the cracked regions, the applicant conducted the testing summarized above. The results demonstrate that the reinforcement was able to develop yield stress in conditions worse than those identified in the shield building (i.e. larger crack widths). The fact that the reinforcement was capable of developing yield stress during loading indicates that the reinforcement did not suffer any significant reduction in bond strength due to the cracking and the shield building will continue to behave as designed. These test results show that the original operability calculations were conservative and indicate that the laminar cracking in the shield building has had little to no effect on the margin in the design. Because of this, the staff believes any changes in the laminar cracking during the period of extended operation would have to be significant in order to invalidate the assumptions in the operability calculation and to lead to a loss of function. Prior to any changes becoming significant enough to cause a possible shield building loss of function, the changes, either in crack width or overall dimensions, would manifest as a discernible change in one of the selected core bores. Therefore, the staff finds the applicant's proposed number of core bore inspections acceptable because the sample size provides reasonable assurance that changes in laminar cracking will be identified prior to a loss of intended function. The staff's concerns regarding the adequacy of the core bore inspection sample size and the location of the inspected core bore openings, and the portions of followup RAI B.2.43-2 and RAI B.2.43-2a discussing this issue, are resolved. As noted above, the purpose of this review was not to confirm the adequacy of the applicant's current licensing basis; that is an ongoing process which is conducted independent of license renewal. The purpose of this portion of the review was to verify the applicant's proposed Shield Building Monitoring Program provided for an appropriate number of core bore samples to identify aging degradation during the period of extended operation.

Based on its review of followup RAI B.2.43-2 and RAI B.2.43-2a, and the program as submitted by letter dated November 20, 2012, the staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4 and, therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.43 states that the Shield Building Monitoring Program will include a baseline inspection followed by periodic inspections. Inspection findings will be documented and evaluated such that the results can be trended. The applicant further stated that findings that do not meet acceptance criteria will be evaluated and tracked using the corrective action program.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that this element should describe "how" data collected are evaluated.

Based on its review, the staff finds the monitoring and trending actions are acceptable because the inspection findings are being documented and evaluated by personnel qualified in accordance with industry standards, specifically ACI 349.3R, as recommended by the GALL Report. If inspection results do not meet the acceptance criteria they will be evaluated and tracked, and the inspection frequency will be revised as necessary.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5 and, therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.43 states that for core bore inspections, unacceptable inspection findings will include any indication of new cracking or a "discernible change" in previously identified cracks. The applicant stated that a discernible change is defined as a visual inspection finding that there has been a change in general appearance or in crack width as identified by crack comparator measurement. The acceptance criteria for the concrete surface inspections will be as described in Chapter 5 of ACI Report 349.3R and the quantitative acceptance criteria of Chapter 5, Sections 5.1.4 and 5.2.4 will be used for the exterior coatings.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. The acceptance criteria should ensure that the intended functions are maintained consistent with all CLB design conditions during the period of extended operation.

The staff noted that the LRA, as amended, states that the acceptance criteria for coatings will include the quantitative acceptance criteria from Chapter 5, Sections 5.1.4 and 5.2.4; however, past RAI responses and the wording of license renewal Commitment No. 20 (submitted via RAI response dated May 24, 2011), related to the Structures Monitoring Program, appeared to contradict this statement. Therefore, by letter dated January 4, 2013, the staff issued RAI B.2.43-3a requesting the applicant clarify what acceptance criteria will be used for inspections of all external concrete coatings on structures within the scope of license renewal. The staff further discussed this issue with the applicant in conference calls dated January 16 and 23, 2013.

By letter dated February 12, 2013, the applicant responded and stated that inspections of external coatings on concrete structures within the scope of license renewal will be performed in accordance with ACI 349.3R. The applicant further stated that inspections of coatings will be performed in accordance with the quantitative acceptance criteria for coatings in Chapter 5, Sections 5.1.4 and 5.2.4 of ACI 349.3R. The staff also noted that Commitment No. 20 and the associated portions of the Structures Monitoring Program were updated accordingly. The staff reviewed the applicant’s response and finds it acceptable because it clearly stated that the external coatings on concrete structures within the scope of license renewal will be inspected in accordance with the quantitative acceptance criteria in ACI 349.3R, which is the GALL Report recommended acceptance criteria. The staff’s concerns identified in RAI B.2.43-3a, regarding coating inspection acceptance criteria, are resolved.

The staff also reviewed the applicant’s acceptance criteria for the core bore inspections and the concrete surface inspections and finds them acceptable. The acceptance criterion for the core bore inspections is effectively no change. Any indication of crack growth, or a new crack, will be evaluated and entered into the corrective action program. The acceptance criteria for the surface inspections aligns with the criteria in ACI 349.3R, which is the GALL Report recommended acceptance criteria for concrete inspections.

The staff confirmed that the “acceptance criteria” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.43 summarizes operating experience related to the Shield Building Monitoring Program. The LRA states the laminar cracking was not caused by an aging mechanism; however, it is prudent to establish a plant-specific aging management program to include monitoring methods to identify aging effects that may occur in the future. The applicant also explained that the existing maintenance rule structural inspections did not, and would not, detect the cracking. The new Shield Building Monitoring Program is designed to identify and evaluate potential aging effects within the shield building walls and to identify and evaluate any loss of effectiveness of the concrete coatings. The applicant further stated that industry operating experience regarding similar structures was evaluated. The only other similar instance was associated with creating a temporary access opening in the post-tensioned containment at Crystal River Unit 3. The root cause of the delamination at Crystal River Unit 3 was found to be the design of the structure, in combination with the type of concrete used and the act of detensioning the structure. In the root cause analysis, the applicant concluded that the Crystal River Unit 3 operating experience was not applicable to the shield building. The applicant further stated that industry and plant-specific operating experience will be considered in the implementation of the program and as additional operating experience is obtained; lessons learned will be incorporated as appropriate.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that consideration of future plant-specific and operating experience relating to AMPs should be discussed. Operating experience with similar existing programs should be discussed. The operating experience of AMPs that are existing programs, including past corrective actions resulting in program enhancements or additional programs, should be considered.

The staff noted that the applicant reviewed industry operating experience and plant-specific experience with maintenance rule inspections of the shield building when developing the new program. In addition the applicant stated that future operating experience would be reviewed and incorporated into the program as necessary.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

USAR Supplement. LRA Section A.1.43 provides the USAR supplement for the Shield Building Monitoring Program. The staff reviewed this USAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1. The staff noted that the USAR supplement states that the acceptance criteria for coatings will include the quantitative acceptance criteria from Chapter 5, Sections 5.1.4 and 5.2.4; however, past RAI responses and the wording of license renewal Structures Monitoring Program Commitment No. 20 (RAI response dated May 24, 2011), appeared to contradict this statement. Therefore, by letter dated January 4, 2013, the staff issued RAI B.2.43-3a requesting the applicant clarify what acceptance criteria will be used for inspections of all external concrete coatings on structures within the scope of license renewal. The staff further discussed this issue with the applicant in conference calls dated January 16 and 23, 2013.

By letter dated February 12, 2013, the applicant responded and stated that inspections of external coatings for concrete structures within the scope of license renewal will be performed in accordance with ACI 349.3R. Commitment No. 20 and the associated portions of the Structures Monitoring Program were updated accordingly. The staff reviewed the applicant's response and finds it acceptable because it clearly states that the external coatings on concrete structures within the scope of license renewal will be inspected in accordance with the quantitative acceptance criteria in ACI 349.3R, and the wording in the USAR supplement and commitment was updated accordingly. The staff's concern in RAI B.2.43-3a, regarding appropriate documentation in the USAR supplement, is resolved.

The staff further noted that the supplement description contained an appropriate level of detail, including a discussion of the core bore sample size, frequency of inspections, acceptance criteria, inspector qualifications, and a reference to the appropriate industry guidance documents, specifically ACI Report 349.3R. The staff also notes that the applicant committed

(Commitment No. 46) to implement the new Shield Building Monitoring Program prior to entering the period of extended operation for managing aging of applicable components. As noted above, the applicant also committed (Commitment No. 20) to use the acceptance criteria of ACI 349.3R for inspection of the coatings.

Based on its review, the staff determines that the information in the USAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Shield Building Monitoring Program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

3.0.4.1 Summary of Technical Information in the Application

In Appendix A, "Updated Safety Analysis Report Supplement," Section A.1, "Summary Descriptions of Aging Management Programs and Activities," and Appendix B, "Aging Management Programs," Section B.1.3, "Quality Assurance Program and Administrative Controls," of the LRA, the applicant described the elements of corrective action, confirmation process, and administrative controls that are applied to the AMPs for both safety-related and nonsafety-related components. The applicant's Quality Assurance Program Manual (QAPM) is used, which includes the elements of corrective action, confirmation process, and administrative controls. Corrective actions, confirmation process, and administrative controls are applied in accordance with the QAPM regardless of the safety classification of the components. Appendix A, Section A.1, and Appendix B, Section B.1.3, of the LRA state that the QAPM implements the requirements of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," and is consistent with NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)," Revision 1. The QAPM is incorporated by reference in USAR Section 17.

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 remain consistent with the CLB for the period of extended operation. The SRP-LR, BTP RLSB-1, "Aging Management Review—Generic," describes ten attributes of an acceptable AMP. Of these 10 attributes, 3 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 BTP RLSB-1 provides the following description of these quality attributes:

- Attribute No. 7—Corrective actions, including root cause determination and prevention of recurrence, should be timely.
- Attribute No. 8—Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

- Attribute No. 9—Administrative controls should provide a formal review and approval process.

The SRP-LR, BTP IQMB-1, "Quality Assurance for Aging Management Programs," states that those aspects of the AMP that affect quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing 10 CFR Part 50, Appendix B, QA Program may be used to address the elements of corrective action, confirmation process, and administrative control. BTP IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

> Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The staff reviewed the applicant's AMPs, described in Appendix A and Appendix B of the LRA, and the associated implementing procedures. 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 BTP IQMB-1. Based on the staff's evaluation, the descriptions of the AMPs and their associated quality attributes—provided in Appendix A, Section A.1, 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 the staff's evaluation, the descriptions and applicability of the plant-specific AMPs and their associated quality attributes—provided in Appendix A, Section A.1, and Appendix B, Section B.1.3 of the LRA—were determined to be consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (corrective action, confirmation process, and administrative control) of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.0.5 Operating Experience for Aging Management Programs

3.0.5.1 Summary of Technical Information in Application

LRA Section B.1.4 describes the consideration of operating experience for AMPs. As an input to the AMP evaluations, the LRA states that the applicant reviewed industry and plant-specific operating experience for existing and new programs and for components to be managed by new plant programs and activities. The LRA also states that industry operating experience was considered from the license renewal guidance documents and, after their publication in 2005, from searches of information in NRC generic communications, the INPO, and the World Association of Nuclear Operators, as contained in the applicant's Corrective Action Program. The applicant also reviewed plant records from January 2001 and later to identify examples of age-related degradation. The scope of this review included reports generated under the Corrective Action Program and applicant event reports. In addition, the LRA states that the applicant's operating experience review considered the results of programmatic assessments performed by the applicant and from outside agencies, including the NRC. Further, some of the program descriptions in LRA Appendix B indicate that future operating experience will be considered. For example, LRA Section B.2.9 states that, "Industry and plant-specific operating experience will be considered in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be incorporated, as appropriate." Another example is in LRA Section B.2.21, which states that:

> The quarterly Plant Health Report includes a system health evaluation of the medium-voltage AC system. A large part of this evaluation involves underground medium-voltage cables. The evaluation addresses Davis-Besse and industry operating experience on medium-voltage cable issues, and also provides a listing of cables that are planned to be replaced in the near future. Industry operating experience will be considered in development of this program, along with input from EPRI guidance documents.

3.0.5.2 Staff Evaluation

Pursuant to 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effect 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. SRP-LR, Revision 2, Appendix A, describes 10 elements of an acceptable AMP. SRP-LR Section A.1.2.3.10 describes Element 10, "Operating Experience," as consisting of these three attributes:

> (1) Consideration of future plant-specific and industry operating experience relating to AMPs should be discussed. Reviews of operating experience by the applicant in the future may identify areas where AMPs should be enhanced or new programs developed. An applicant should commit to a future review of plant-specific and industry operating experience to confirm the effectiveness of its AMPs or indicate a need to develop new AMPs. This information should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the period of extended operation.
>
> (2) Operating experience with existing programs should be discussed. The operating experience of AMPs that are existing programs, including past corrective actions resulting in program enhancements or additional programs, should be considered. A past failure would not necessarily invalidate an AMP because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information can show where an existing program has succeeded and where it has failed (if at all) in intercepting aging degradation in a timely manner. This information should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure- and component-intended function(s) will be maintained during the period of extended operation.
>
> (3) For new AMPs that have yet to be implemented at an applicant's facility, the programs have not yet generated any operating experience […]. However, there may be other relevant plant-specific [operating

> experience] at the plant or generic [operating experience] in the industry that is relevant to the AMP's program elements even though the [operating experience] was not identified as a result of the implementation of the new program. Thus, for new programs, an applicant may need to consider the impact of relevant [operating experience] that results from the past implementation of its existing AMPs that are existing programs and the impact of relevant generic operating experience on developing the program elements. Therefore, operating experience applicable to new programs should be discussed. Additionally, an applicant should commit to a review of future plant-specific and industry operating experience for new programs to confirm its effectiveness.

SER Section 3.0.3 discusses the staff's review of the second and third attributes, which concern operating experience associated with existing and new programs, respectively. The below evaluation discusses the staff's review of the first attribute, which concerns the consideration of future operating experience and applies to both existing and new programs.

The staff reviewed LRA Sections B.1.4 and B.2.1–B.2.40 to determine whether the applicant will implement adequate activities for the ongoing review of both plant-specific and industry operating experience to identify areas where the AMPs should be enhanced or new AMPs developed. The staff determined that, while these LRA sections describe how the applicant incorporated operating experience into its AMPs, they do not fully describe how the applicant will consider future operating experience. The main focus of these LRA sections is on how the applicant evaluated operating experience available at the time the application was prepared to justify the adequacy of its proposed AMPs. Some of the program descriptions, particularly for new programs, contain statements indicating that future plant-specific and industry operating experience will be used to adjust the AMPs as appropriate, but the details of this process are not described. For the majority of AMPs, it is not clear whether the applicant intends to monitor operating experience on an ongoing basis and to use it to ensure the continued effectiveness of the AMPs or to develop new AMPs, as necessary.

By letter dated May 19, 2011, the staff issued RAI B.1.4-1 requesting that the applicant describe in detail the programmatic activities that will be used to continually identify aging issues, evaluate them, and, as necessary, enhance the AMPs or develop new AMPs. The staff requested the applicant to address the following items in the response:

- sources of plant-specific and industry operating experience information reviewed on an ongoing basis
- criteria for determining when operating experience concerns aging
- training of plant personnel for identifying age-related issues
- evaluation of operating experience to determine its potential impact on the plant aging management activities
- consideration of SCs, their materials, environments, aging effects, aging mechanisms, and AMPs in operating experience evaluations
- consideration of AMP inspections results
- records kept of operating experience evaluations

- process for the timely implementation of enhancements identified through operating experience evaluations
- administrative controls over the operating experience review activities

In its response dated June 24, 2011, the applicant stated that it currently has a procedurally controlled operating experience review process pursuant to item I.C.5, “Procedures for Feedback of Operating Experience to Plant Staff,” of NUREG-0737, “Clarification of TMI Action Plan Requirements,” dated November 1980. The applicant stated that this process provides for the systematic identification and transfer of lessons learned from site and industry experience into fleet and station processes to prevent events and enhance the safety and reliability of plant operations. The applicant also stated that the review process addresses conditions that might warrant a change to plant equipment or processes, without limiting the specific types of degradation or conditions to be considered. In addition, the applicant stated that the process includes screening of operating experience to determine whether further evaluation is required, based on susceptibility to the condition, and to identify and assign appropriate reviewers. Additionally, operating experience that potentially represents a condition adverse to quality is entered into the Corrective Action Program.

The staff reviewed the applicant’s response to RAI B.1.4-1 and determined that it provides a general description of the processes used to evaluate operating experience on an ongoing basis; however, it does not provide specific information on how these processes address aging-related issues. The staff determined that further information on the operating experience review activities was necessary, such as:

- the sources of operating experience reviewed on an ongoing basis
- identification of operating experience related to aging
- training of personnel responsible for processing operating experience
- information considered in operating experience evaluations
- consideration of AMP implementation results as operating experience
- content of operating experience evaluation records
- prioritization and timely completion of operating experience evaluations
- criteria for modifying AMPs or developing new AMPs
- reporting of plant-specific operating experience on aging degradation to the industry

By letter dated December 27, 2011, the staff issued RAI B.1.4-2, asking the applicant to provide additional details on how the operating experience review activities will specifically address aging.

By letter dated March 9, 2012, the applicant responded to RAI B.1.4-2. In its response, the applicant described the sources of internal and external operating experience that it will review to identify age-related degradation issues. The applicant also described how the Operating Experience Program and Corrective Action Program will be used to identify, screen, and process age-related operating experience. On training, the applicant stated that a “needs analysis” will be used to determine enhancements to the training requirements for personnel involved with the operating experience review process. The applicant provided details on the information that will be considered in operating experience evaluations and explained how these evaluations will be documented and processed. In addition, the applicant described its consideration of AMP implementation results as operating experience and described the criteria for identifying when to modify or create new AMPs. The applicant further described the screening and reporting of its internal operating experience to the industry. The applicant also identified several enhancements to its existing operating experience review activities.

After receipt of the applicant's response to RAI B.1.4-2, on March 9, 2012, the staff issued Final License Renewal Interim Staff Guidance-, LR-ISG-2011-05, "Ongoing Review of Operating Experience." LR-ISG-2011-05 provides a framework for operating experience review activities to ensure that they will adequately address operating experience concerning age-related degradation and aging management during the term of a renewed operating license. When the staff prepared the SER with Open Items, it was still reviewing the applicant's response to RAI B.1.4-2 with consideration of the guidance in LR-ISG-2011-05. The staff identified the completion of this review as OI B.1.4-1.

LR-ISG-2011-05 revises the SRP-LR to clarify the staff's acceptance criteria and review procedures with respect to the review of operating experience for license renewal. Appendix A to the LR-ISG identifies the necessary revisions to the SRP-LR. Itemized Change No. 7 establishes a new SRP-LR Section A.4. The staff evaluated the details of the applicant's ongoing operating experience review activities, as described in response to RAIs B.1.4-1 and B.1.4-2, with consideration of the guidance in SRP-LR Section A.4.

SRP-LR Section A.4.2 describes existing programs acceptable to the staff for the capture, processing, and evaluation of operating experience concerning age-related degradation and aging management during the term of a renewed operating license. The specific programs and procedures acceptable to the staff are those relied upon to meet the requirements of 10 CFR Part 50, Appendix B, and NUREG-0737, item I.C.5. In addition, SRP-LR Section A.4.2 states that, as part of meeting the requirements of NUREG-0737, item I.C.5, the applicant's Operating Experience Program should rely on active participation in the INPO Operating Experience Program [formerly the INPO Significant Event Evaluation and Information Network (SEE-IN) program endorsed in NRC GL 82-04, "Use of INPO SEE-IN Program"]. The applicant response to RAI B.1.4-1 states that the applicant currently has a procedurally controlled operating experience review process, as required by NUREG-0737, item I.C.5. The applicant response also states that procedures list a variety of operating experience sources and documents for review, including event reports and operating experience from INPO. Additionally, the applicant response states that the Corrective Action Program is considered the primary source of plant-specific operating experience because adverse conditions, including ones related to aging, are documented in the program's database. LRA Section B.1.3 indicates that the Corrective Action Program satisfies the requirements of 10 CFR Part 50, Appendix B. Therefore, the staff finds the applicant's use of these existing programs acceptable because they are used to fulfill the requirements of NUREG-0737, item I.C.5, and 10 CFR Part 50, Appendix B, consistent with the staff's position in SRP-LR Section A.4.2.

In addition to stating the staff's general acceptance of existing programs for the review of operating experience, SRP-LR Section A.4.2 describes several areas of further review to ensure that these programs are adequate for license renewal. These areas of concern are the following:

- application of existing programs and procedures to the processing of operating experience related to aging
- consideration of guidance documents as operating experience
- screening of incoming operating experience
- identification of operating experience related to aging

- information considered in operating experience evaluations
- evaluation of AMP implementation results
- training
- reporting operating experience to the industry
- schedule for implementing the operating experience review activities

The staff's evaluation of each area follows.

<u>Application of Existing Programs and Procedures to the Processing of Operating Experience Related to Aging</u>. SRP-LR Section A.4.2 states that the programs and procedures relied upon to meet the requirements of 10 CFR Part 50, Appendix B, and NUREG-0737, item I.C.5, should not preclude the consideration of operating experience on age-related degradation and aging management. In response to RAI B.1.4-1, the applicant stated that its operating experience review process, which is implemented in accordance with the requirements of NUREG-0737, item I.C.5, addresses conditions that might warrant a change to plant equipment or processes without limiting consideration to specific types of degradation or conditions. The applicant also stated that operating experience that potentially represents a condition adverse to quality is entered into the Corrective Action Program. Further, in response to RAI B.1.4-2, the applicant stated that the Corrective Action Program has an appropriate threshold for capturing issues concerning aging because the program requires documentation of adverse conditions regardless of their nature. The applicant also stated that personnel training, procedural guidance, and oversight ensure that adverse conditions, including conditions involving aging, are appropriately captured and evaluated. Per LRA Section B.1.3, the Corrective Action Program satisfies the requirements of 10 CFR Part 50, Appendix B. The staff reviewed the applicant's criteria for processing operating experience within the Corrective Action Program and Operating Experience Program. The staff determined that these programs are acceptable because they would not preclude the capture and processing of operating experience related to aging. The applicant's use of these programs for the processing of operating experience related to aging is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

SRP-LR Section A.4.2 also states that the applicant should use the option described in SRP-LR Appendix A.2 to expand the scope of its 10 CFR Part 50, Appendix B, Program to include nonsafety-related SCs. As discussed in SER Section 3.0.4, the staff determined that the applicant's application of the 10 CFR Part 50, Appendix B, Program to nonsafety-related SCs is consistent with the guidance in SRP-LR Appendix A and, therefore, also consistent with the guidance in SRP-LR Section A.4.2.

<u>Consideration of Guidance Documents as Operating Experience</u>. SRP-LR Section A.4.2 states that revisions to the GALL Report should be considered as a source of operating experience and evaluated accordingly. In response to RAI B.1.4-2, the applicant stated that it does not consider NRC NUREG-series publications, such as the GALL Report, to be operating experience. Subsequently, on August 1, 2012, the staff held a teleconference with the applicant to discuss consistency between the proposed operating experience review activities and the guidance in LR-ISG-2011-05. In this teleconference, the applicant indicated that it intended to review revisions to the GALL Report under its Operating Experience Program and stated that it would supplement the response to RAI B.1.4-2 to clarify this intent. By letter dated August 16, 2012, the applicant stated that it will review revisions to the GALL Report. The staff finds this response acceptable because treating the GALL Report as a source of operating experience is consistent with the guidance in SRP-LR Section A.4.2.

SRP-LR Section A.4.2 also states that staff and industry guidance documents and standards applicable to aging management should be considered as sources of operating experience. In response to RAI B.1.4-2, the applicant stated that it is kept informed of the issuance of new or revised guidance documents on age-related topics through involvement in industry groups and committees that regularly share industry operating experience and identify changes to guidance documents. Regarding staff guidance documents, the applicant stated that its Operating Experience Program does not list them as sources to be reviewed, but the program does include review of staff RIS, which the staff can use to inform applicants of changes to guidance documents. The applicant also stated that the Operating Experience Program allows for the processing of non-prescribed sources on a case-by-case basis. The staff reviewed the response and finds the applicant's consideration of guidance documents acceptable because the applicant has means to keep informed of new staff and industry guidance documents and standards, and these documents can be entered into the Operating Experience Program and evaluated for impacts to the aging management activities.

Screening of Incoming Operating Experience. SRP-LR Section A.4.2 states that all incoming plant-specific and industry operating experience should be screened to determine whether it may involve age-related degradation or impacts to aging management activities. In response to RAI B.1.4-2, the applicant described its screening process for external operating experience items. The applicant explained that it first determines applicability to Davis-Besse and then conducts further screening. Actions as a result of this further screening include writing a condition report in the Corrective Action Program if an adverse condition is identified or initiating a formal evaluation. The applicant also stated that it will enhance its Operating Experience Program to require consideration of information pertinent to aging in evaluations of age-related operating experience issues for structures and passive components. The applicant also stated that it will make a similar enhancement to the Corrective Action Program for condition report investigations of age-related issues. In addition, the applicant stated that it will enhance the Corrective Action Program so that the Corrective Action Review Board will question whether aging was considered in condition report investigations. The staff reviewed the applicant's response and finds it acceptable because the applicant's processes for screening operating experience involve consideration of whether aging may be involved with further evaluation of the impacts to aging management. The applicant's screening of operating experience is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Identification of Operating Experience Related to Aging. SRP-LR Section A.4.2 states that an identification code should be used in the Corrective Action Program to identify operating experience concerning age-related degradation applicable to the plant. In response to RAI B.1.4-2, the applicant stated that it processes and investigates age-related operating experience issues in the Corrective Action Program in the same manner as other adverse conditions. The applicant also stated that industry age-related operating experience items are received and screened no differently than other items and explained that items are not typically received with an "aging" designator. The staff reviewed this response and determined that the applicant does not specifically identify operating experience as related to aging under its existing programs. On August 1, 2012, the staff held a teleconference with the applicant to clarify whether the applicant intends to create an age-related identification code consistent with the guidance in LR-ISG-2011-05. In the teleconference, the applicant stated that it will include an "aging" flag in both the Corrective Action Program and Operating Experience Program databases to identify plant-specific and industry operating experience concerning age-related degradation. The applicant also stated that it would supplement its response to RAI B.1.4-2 to clarify this intent. By letter dated August 16, 2012, the applicant provided the supplemental information, stating that an "aging" flag will be used to identify plant-specific and industry operating experience concerning age-related degradation to SCs within the scope of license renewal and managed by a license renewal AMP. The staff reviewed this response and finds it acceptable because operating experience will be specifically identified and recorded as involving aging. This identification is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Information Considered in Operating Experience Evaluations. SRP-LR Section A.4.2 states that operating experience identified as potentially involving aging should receive further evaluation that takes into account information such as SSCs, materials, environments, aging effects, aging mechanisms, and AMPs. In response to RAI B.1.4-2, the applicant stated that it will enhance its Corrective Action Program to require that a condition report investigation of an aging-related issue for structures and passive components include consideration of the affected structure or component, material, environment, aging effect, aging mechanism, and AMP, with feedback to the affected AMP owner for consideration of the impact to AMP's effectiveness. The applicant also stated that it will enhance the Operating Experience Program to require consideration of the same information for industry aging-related operating experience items that require an evaluation. The staff finds acceptable the information that will be considered in the applicant's operating experience reviews because the reviews will identify potential aging issues and consider the fundamental components of an AMR, namely the potentially affected plant SCs, materials, environments, aging effects, aging mechanisms, and AMPs. Consideration of this information in the operating experience reviews will help to address all potential impacts to the aging management activities. The information considered in the applicant's evaluations of operating experience related to aging is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

SRP-LR Section A.4.2 also states that a corrective action should be entered into the 10 CFR Part 50, Appendix B, Program to either enhance the AMPs or develop and implement new AMPs if it is found through an operating experience evaluation that the effects of aging may not be adequately managed. In response to RAI B.1.4-2, the applicant stated that revision of existing or development of new AMPs based on operating experience evaluations is accomplished through corrective actions in the Corrective Action Program or by action items in the Operating Experience Program. The applicant also stated that assigned program owners will develop revisions to the AMP implementing procedures based on the results of the operating experience evaluation, and new AMP implementing procedures will be developed based on the activities involved and affected SSCs. In addition, the applicant stated that the Corrective Action Program requires development of actions that are effective to address conditions adverse to quality. The applicant explained that adverse aging-related conditions identified through plant-specific or industry operating experience can involve identification of a new aging effect, adverse aging-related trend, AMP weakness, or ineffective management of an applicable aging effect or aging mechanism. The staff reviewed these processes and finds them acceptable because they provide for the revision of AMPs or the creation of new AMPs as a result of operating experience evaluations.

Evaluation of AMP Implementation Results. SRP-LR Section A.4.2 states that the results of implementing each AMP, such as data from inspections, tests, and analyses, should be evaluated regardless of whether the acceptance criteria of the particular AMP have been met. SRP-LR Section A.4.2 also states that this information should be used to determine whether to adjust the frequency of future inspections, establish new inspections, and adjust or expand the inspection scope. It also states that a corrective action should be entered into the 10 CFR Part 50, Appendix B, Program to either enhance the AMPs or develop and implement new AMPs if there is an indication that the effects of aging may not be adequately managed. In response to RAI B.1.4-2, the applicant stated that AMP activities that identify degraded or non-conforming conditions or results that do not meet the defined acceptance criteria will be considered as adverse conditions and documented in condition reports in the Corrective Action Program. The applicant also stated that AMP results that meet the defined acceptance criteria will also be considered as operating experience for the affected AMP, and these results will be used as feedback for trending purposes and for evaluation to determine—based on the component, material, environment, and aging effect combinations managed—whether the frequency of future inspections needs to be adjusted or whether new inspections need to be established. Additionally, the applicant stated that the Corrective Action Program is used to revise existing AMPs or develop new AMPs based on operating experience evaluations. The staff reviewed this response and finds acceptable the applicant's treatment of the AMP implementation results as operating experience because the applicant will evaluate these results and use the information to determine whether to adjust the aging management inspection activities. The applicant's activities for the evaluation of the AMP implementation results are, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Training. SRP-LR Section A.4.2 states that training on age-related degradation and aging management should be provided to those personnel responsible for implementing the AMPs and those personnel that may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience. SRP-LR Section A.4.2 also states that the training should occur on a periodic basis and include provisions to accommodate the turnover of plant personnel. In response to RAI B.1.4-2, the applicant stated that the training requirements for operating experience involve completion of position-specific document and procedure reviews, proficiency demonstrations, and interviews, with oversight from a recognized technical expert qualified to perform the specific tasks. The applicant also stated that it will complete a training "needs analysis" to determine and document recommended enhancements to the training requirements for those personnel responsible for screening, evaluating, and submitting aging-related operating experience items. The staff reviewed the applicant's training requirements and determined that additional information was necessary because the applicant did not clearly establish the goals of the training "needs analysis." Therefore, by letter dated June 12, 2012, the staff issued RAI B.1.4-4, requesting that the applicant clarify the objectives of this analysis with respect to the training on aging-related operating experience and maintenance of AMPs.

By letter dated July 11, 2012, the applicant responded to RAI B.1.4-4. The applicant stated that the needs analysis will be used to determine the training needs for a given position-specific job function. The applicant explained that the needs analysis is used with applicable job and task analyses to determine the topics, content, and frequency of training. The applicant further stated that, with respect to aging-related operating experience and maintenance of AMPs, the needs analysis will result in new training materials or modifications to existing training materials for those positions responsible for screening, evaluating, and submitting aging-related operating experience items and implementing changes to the AMPs.

The staff reviewed the applicant's responses to RAIs B.1.4-2 and B.1.4-4 against the criteria on training in SRP-LR Section A.4.2. The staff finds the applicant's training activities acceptable because training on age-related degradation and aging management topics will be required of personnel responsible for implementing the AMPs and for processing operating experience related to aging. The staff also finds that the applicant's training needs analysis is acceptable because it will establish the scope and periodicity of training based on position-specific responsibilities. In addition, the staff finds that the applicant's training activities will account for personnel turnover because training will be required on a position-specific, rather than individual, basis. The applicant's training activities are, therefore, consistent with the guidance in SRP-LR Section A.4.2

Reporting Operating Experience to the Industry. SRP-LR Section A.4.2 states that guidelines should be established for reporting plant-specific operating experience on age-related degradation and aging management to the industry. In response to RAI B.1.4-2, the applicant stated that noteworthy plant-specific operating experience is shared with the industry if it is important to nuclear, public, radiological, and personnel safety; concerns events with important generic implications; or concerns lessons learned that would be beneficial to know about if the event had occurred at another station. The staff reviewed these reporting guidelines and determined that they do not specifically address the reporting of aging-related operating experience. On August 1, 2012, the staff held a teleconference with the applicant to clarify whether the reporting guidelines specifically address aging. In the teleconference, the applicant stated that it intended to change its Operating Experience Program to include details on reporting plant-specific operating experience concerning age-related degradation. The applicant also stated that it would supplement its response to RAI B.1.4-2 to clarify this intent. By letter dated August 16, 2012, the applicant supplemented its response to RAI B.1.4-2. In its supplemental response the applicant stated that plant-specific operating experience will be shared with the industry in accordance with evaluation criteria for events or issues related to aging management, such as the discovery of a previously unknown or unexpected aging effect or mechanism or a significant change to an AMP. The staff finds these reporting guidelines acceptable because they specifically cover circumstances in which plant-specific operating experience related to aging management and age-related will be reported to the industry. The applicant's establishment of these reporting guidelines is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Schedule for Implementing the Operating Experience Review Activities. SRP-LR Section A.4.2 states that enhancements to the existing operating experience review activities should be put in place no later than the date that the renewed operating license is issued. In RAI B.1.4-2, the staff requested that the applicant identify any such enhancements and provide a schedule for their implementation. In response, the applicant described four enhancements related to training activities and procedure changes and stated that these enhancements will be completed by December 31, 2012. By letter dated January 7, 2013, the applicant confirmed that it had completed the enhancements per this schedule. Since completion of the enhancements occurred before issuance of the renewed license, the implementation schedule is acceptable because it is consistent with the guidance in SRP-LR Section A.4.2.

SRP-LR Section A.4.2 also states that the operating experience review activities should be implemented on an ongoing basis throughout the term of the renewed license. By letter dated August 17, 2011–as revised by letters dated March 9, 2012, July 11, 2012, and August 16, 2012–the applicant amended the USAR supplement in the LRA to include a summary description of the ongoing operating experience review activities. As discussed below in SER Section 3.0.5.3, the staff finds that this summary description is sufficiently comprehensive to describe the applicant's programmatic operating experience review activities for license renewal. On issuance of a renewed license, in accordance with 10 CFR 54.3(c), this summary description will be incorporated into the plant's CLB. At that time, the applicant will be obligated to conduct its operating experience review activities accordingly. Therefore, the staff finds the implementation schedule acceptable because the applicant will implement the operating experience review activities on an ongoing basis throughout the term of the renewed operating license. The applicant's implementation of these activities is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Based on its review of the application and the applicant's responses to RAIs B.1.4-1, B.1.4-2, and B.1.4-4, and with consideration of the guidance in LR-ISG-2011-05, the staff determined that the applicant's programmatic activities for the ongoing review of operating experience are acceptable because the systematic review of plant-specific and industry operating experience ensures that the license renewal AMPs are and will continue to be effective in managing the aging effects for which they are credited. Additionally, the applicant is committed to enhancing or developing new AMPs when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Therefore, the staff's concerns described in RAIs B.1.4-1, B.1.4-2, and B.1.4-4, are resolved, and OI B.1.4-1 is closed.

3.0.5.3 USAR Supplement

The staff reviewed the USAR supplement in LRA Appendix A to determine whether the applicant provided an adequate summary description of the programmatic activities for the ongoing review of operating experience. As the staff found no such description, it also requested in RAI B.1.4-1 that the applicant provide a description of these activities for the USAR supplement required by 10 CFR 54.21(d).

In its response dated June 24, 2011, the applicant stated that the operating experience review process is part of the CLB, which will be maintained during the period of extended operation. The applicant stated that it considers the review of operating experience to be an element of all the AMPs, rather than a separate program and, therefore, no summary description in the USAR supplement is needed.

On July 12, 2011, the staff held a teleconference with the applicant to reiterate the need for a summary description of the operating experience review activities in the USAR supplement. By letter dated August 17, 2011, the applicant revised LRA Appendix A to include this description of the operating experience review activities:

> Existing FENOC processes require reviews of relevant site and industry operating experience and periodic benchmarking to ensure program enhancements are identified and implemented. Such ongoing reviews identify potential needs for aging management program revisions to ensure their effectiveness throughout the period of extended operation.

The staff reviewed this summary description in conjunction with the applicant's description of the operating experience review activities provided in response to RAI B.1.4-1. The staff determined that the response generally describes how the applicant intends to consider operating experience on an ongoing basis; however, the response does not provide specific information as to how the operating experience review activities will specifically address issues related to aging. The staff determined that the USAR supplement entry proposed by letter dated August 17, 2011, also lacks detail as to how aging is considered in these activities. Therefore, by letter dated December 27, 2011, the staff issued RAI B.1.4-3, requesting that the applicant provide additional detail in the USAR supplement. By letter dated March 9, 2012, the applicant responded to RAI B.1.4-3 by providing a revised summary description with an expanded description of the operating experience review processes to explain how aging issues are considered under these processes.

The summary description provided by letter dated March 9, 2012, was subsequently revised. By letter dated July 11, 2012, the applicant revised it to provide clarification regarding training related to operating experience and to better align the summary description with the guidance in

LR-ISG-2011-05. By letter dated August 16, 2012, the applicant further revised it to reflect that: (a) revisions to the GALL Report will be reviewed under the Operating Experience Program; (b) that plant-specific and industry operating experience concerning age-related degradation will be identified in the Corrective Action Program and Operating Experience Program; and (c) that plant-specific events or issues related to aging management will be reported to the industry in accordance with established criteria.

LR-ISG-2011-05, Appendix A, identifies revisions to the SRP-LR for the staff's review of an applicant's activities for evaluating and considering operating experience for license renewal. Itemized Change No. 1 in this appendix provides an example summary description of the operating experience review activities for inclusion in an FSAR supplement. In accordance with the review procedures established in the LR-ISG, the staff compared the applicant's summary description of the operating experience review activities, as provided by letter dated August 16, 2012, against the example summary description in the LR-ISG. The staff determined that the applicant's summary description is consistent with the example in the LR-ISG and also sufficiently comprehensive to describe the applicant's programmatic operating experience review activities for license renewal. Therefore, the staff's concern described in RAI B.1.4-3 is resolved, and the staff finds this USAR supplement summary description acceptable.

3.0.5.4 Conclusion

Based on the staff's review of the applicant's programmatic activities for the ongoing review of operating experience, as described in the applicant's responses to RAIs B.1.4-1, B.1.4-2, B.1.4-3, and B.1.4-4, the staff concludes that the applicant has demonstrated that operating experience will be reviewed to ensure that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for these activities and concludes that it provides an adequate summary description, as required by 10 CFR 54.21(d).

3.1 Aging Management of Reactor Vessel, Internals, Reactor Coolant System and Reactor Coolant Pressure Boundary, and Steam Generators

This section of the SER documents the staff's review of the applicant's AMR results for the RV, RVIs, and RCS components and component groups of the following:

- RPV
- RVIs
- RCS and RCPB
- SGs

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the RPV, RVIs, RCS and RCPB, and SGs. LRA Table 3.1.1, "Summary of Aging Management Programs for Reactor Vessel, Internals, Reactor Coolant System and Reactor Coolant Pressure Boundary, and Steam Generators Evaluated in Chapter IV of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the RCS, RV, RVIs, and SG 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 if the applicant provided sufficient information to demonstrate that the effects of aging for the RPV, RVIs, RCS and RCPB, and SG components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of the applicant's 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 identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Sections 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 that the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR items and the plant's operating experience to verify the applicant's claims.

Table 3.1-1 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	Not applicable	Not applicable to PWRs (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; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy RV components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy RCPB piping, piping components, and piping elements exposed to reactor coolant (3.1.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.1)
Steel pump and valve closure bolting (3.1.1-4)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7,000 cycles) of thermal stress range	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.1)
Stainless steel and nickel-alloy RVIs components (3.1.1-5)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.1)
Nickel-alloy tubes and sleeves in a reactor coolant and secondary feedwater/steam environment (3.1.1-6)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel and stainless steel RCPB closure bolting, head closure studs, support skirts and attachment welds, pressurizer relief tank components, SG components, piping, and components external surfaces and bolting (3.1.1-7)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.1)
Steel; stainless steel; and nickel-alloy RCPB piping, piping components, piping elements; flanges; nozzles and safe ends; pressurizer vessel shell heads and welds; heater sheaths and sleeves; penetrations; and thermal sleeves (3.1.1-8)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy RV components: flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-9)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.1)

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; steel with nickel-alloy or stainless steel cladding; nickel-alloy SG components (flanges; penetrations; nozzles; safe ends, lower heads, and welds) (3.1.1-10)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.1)
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 SER Section 3.1.2.2.2(1))
Steel SG 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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.1.2.2.2(1))
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-13)	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.2(2))
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding RV flanges, nozzles, penetrations, safe ends, vessel shells, heads, and welds (3.1.1-14)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.2(3))

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 RCPB components exposed to reactor coolant (3.1.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.2(3))
Steel SG 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	ISI (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 Davis-Besse (see SER Section 3.1.2.2.2(4))
Steel (with or without stainless steel cladding) RV 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 Part 50, Appendix G, and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations.	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.3(1))
Steel (with or without stainless steel cladding) RV beltline shell, nozzles, and welds; safety injection nozzles (3.1.1-18)	Loss of fracture toughness due to neutron irradiation embrittlement	RV Surveillance	Yes	RV Surveillance	Consistent with GALL Report (see SER Section 3.1.2.2.3(2))
Stainless steel and nickel-alloy top head enclosure vessel flange leak detection line (3.1.1-19)	Cracking due to SCC and intergranular SCC (IGSCC)	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.4(1))

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 isolation condenser components exposed to reactor coolant (3.1.1-20)	Cracking due to SCC and IGSCC	ISI (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.4(2))
RV shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process (3.1.1-21)	Crack growth due to cyclic loading	TLAA	Yes	TLAA	Consistent with GALL Report (see SER Section 3.1.2.2.5)
Stainless steel and nickel-alloy RVIs components exposed to reactor coolant and neutron flux (3.1.1-22)	Loss of fracture toughness due to neutron irradiation, embrittlement, and void swelling	USAR supplement commitment to participate in industry RVI aging programs, implement applicable results, and submit for NRC approval, > 24 months before the extended period, an RVI inspection plan based on industry recommendation.	No, but applicant commitment needs to be confirmed	PWR Reactor Vessel Internals Program	Consistent with GALL Report (see SER Section 3.1.2.2.6)
Stainless steel RV closure head flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Yes	PWR Water Chemistry and Small Bore Class 1 Piping Inspection	Consistent with GALL Report (see SER Section 3.1.2.2.7(1))
Class 1 CASS piping, piping components, and piping elements exposed to reactor coolant (3.1.1-24)	Cracking due to SCC	Water Chemistry and, for CASS components that do not meet the NUREG-0313 guidelines, a plant-specific AMP	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.2.7(2))
Stainless steel jet pump sensing line (3.1.1-25)	Cracking due to cyclic loading	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.8(1))

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 isolation condenser components exposed to reactor coolant (3.1.1-26)	Cracking due to cyclic loading	ISI (IWB, IWC, and IWD) and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.8(2))
Stainless steel and nickel-alloy RVIs screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	USAR supplement commitment to participate in industry RVI aging programs, implement applicable results, and submit for NRC approval, > 24 months before the extended period, an RVI inspection plan based on industry recommendation.	No, but applicant commitment needs to be confirmed	PWR Reactor Vessel Internals Program	Consistent with GALL Report (see SER Section 3.1.2.2.9)
Steel SG feedwater impingement plate and support exposed to secondary feedwater (3.1.1-28)	Loss of material due to erosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.2.10)
Stainless steel steam dryers exposed to reactor coolant (3.1.1-29)	Cracking due to flow-induced vibration	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.2.11)

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 RVIs components (e.g., upper internals assembly, rod cluster control 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, CSS assembly, core barrel assembly, lower grid assembly, flow distributor assembly, thermal shield, instrumentation support structures) (3.1.1-30)	Cracking due to SCC and IASCC	Water Chemistry and USAR supplement commitment to participate in industry RVI aging programs, implement applicable results, and submit for NRC approval, < 24 months before the extended period, an RVI inspection plan based on industry recommendation.	No, but applicant commitment needs to be confirmed	PWR Water Chemistry and PWR Reactor Vessel Internals Program	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 RV head); pressurizer heater sheaths, sleeves, diaphragm plate, manways, and flanges; core support pads/core guide lugs (3.1.1-31)	Cracking due to PWSCC	ISI (IWB, IWC, and IWD) and Water Chemistry and USAR supplement commitment to implement applicable plant commitments to NRC Orders, Bulletins, and GLs associated with nickel alloys and staff-accepted industry guidelines.	No, but applicant commitment needs to be confirmed	ISI, PWR Water Chemistry, Nickel-Alloy Management, and Small Bore Class 1 Piping Inspection Program	Consistent with GALL Report (see SER Section 3.1.2.2.13)
Steel SG feedwater inlet ring and supports (3.1.1-32)	Wall thinning due to flow-accelerated corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to Davis-Besse (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 RVIs components (3.1.1-33)	Changes in dimensions due to void swelling	USAR supplement commitment to participate in industry RVI aging programs, implement applicable results, submit for NRC approval, < 24 months before the extended period, an RVI inspection plan based on industry recommendation.	No, but applicant commitment needs to be confirmed	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.2.15)
Stainless steel and nickel-alloy reactor CRD head penetration pressure housings (3.1.1-34)	Cracking due to SCC and PWSCC	ISI (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the USAR supplement to implement applicable Bulletins and GLs and staff-accepted industry guidelines.	No, but applicant commitment needs to be confirmed	ISI and PWR Water Chemistry	Consistent with GALL Report (see SER Section 3.1.2.2.16(1))
Steel with stainless steel or nickel-alloy cladding primary side components; SG upper and lower heads, tubesheets and tube-to-tube sheet welds (3.1.1-35)	Cracking due to SCC and PWSCC	ISI (IWB, IWC, and IWD) and Water Chemistry and for nickel alloy, comply with applicable NRC Orders and provide a commitment in the USAR supplement to implement applicable Bulletins and GLs and staff-accepted industry guidelines.	No, but applicant commitment needs to be confirmed	ISI and PWR Water Chemistry	Consistent with GALL Report (see SER Section 3.1.2.2.16(1))

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Nickel-alloy, stainless steel pressurizer spray head (3.1.1-36)	Cracking due to SCC and PWSCC	Water Chemistry and One-Time Inspection and, for nickel alloy welded spray heads, comply with applicable NRC Orders and provide a commitment in the USAR supplement to implement applicable Bulletins and GLs and staff-accepted industry guidelines.	No, but applicant commitment needs to be confirmed	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.2.16(2))
Stainless steel and nickel-alloy RVIs components (e.g., upper internals assembly, RCCA guide tube assemblies, lower internal assembly, control element assembly (CEA) shroud assemblies, core shroud assembly, CSS assembly, core barrel assembly, lower grid assembly, flow distributor assembly) (3.1.1-37)	Cracking due to SCC, PWSCC, IASCC	Water Chemistry and USAR supplement commitment to participate in industry RVI aging programs, implement applicable results, and submit for NRC approval, < 24 months before the extended period, an RVI inspection plan based on industry recommendation.	No, but applicant commitment needs to be confirmed	PWR Water Chemistry and PWR Reactor Vessel Internals Program	Consistent with GALL Report (see SER Section 3.1.2.2.17)
Steel (with or without stainless steel cladding) CRD return line nozzles exposed to reactor coolant (3.1.1-38)	Cracking due to cyclic loading	Boiling water reactor (BWR) CRD Return Line Nozzle	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel and nickel-alloy penetrations for CRD stub tubes instrumentation, jet pump instrumentation, standby liquid control, flux monitor, and drain line exposed to reactor coolant (3.1.1-40)	Cracking due to SCC, IGSCC, cyclic loading	BWR Penetrations and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy piping, piping components, and piping elements ≥ 4 NPS; nozzle safe ends and associated welds (3.1.1-41)	Cracking due to SCC and IGSCC	BWR SCC and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-42)	Cracking due to SCC and IGSCC	BWR Vessel ID Attachment Welds and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Stainless steel fuel supports and CRD assemblies CRD housing exposed to reactor coolant (3.1.1-43)	Cracking due to SCC and IGSCC	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, CRD housing, nuclear instrumentation guide tubes (3.1.1-44)	Cracking due to SCC, IGSCC, IASCC	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-45)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Nickel-alloy core shroud and core plate access hole cover (mechanical covers) (3.1.1-46)	Cracking due to SCC, IGSCC, IASCC	ISI (IWB, IWC, and IWD) and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy RVIs exposed to reactor coolant (3.1.1-47)	Loss of material due to pitting and crevice corrosion	ISI (IWB, IWC, and IWD) and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-48)	Cracking due to SCC, IGSCC (for stainless steel only), and thermal and mechanical loading	ISI (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 (see SER Section 3.1.2.1.1)
Nickel-alloy core shroud and core plate access hole cover (welded covers) (3.1.1-49)	Cracking due to SCC, IGSCC, IASCC	ISI (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 (see SER Section 3.1.2.1.1)
High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage (3.1.1-50)	Cracking due to SCC and IGSCC	Reactor Head Closure Studs	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
CASS jet pump assembly castings; orificed fuel support (3.1.1-51)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Not applicable	Not applicable to PWRs (see SER Section 3.1.2.1.1)
Steel and stainless steel RCPB pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems (3.1.1-52)	Cracking due to SCC, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-53)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (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 Davis-Besse (see SER Section 3.1.2.1.1)
CASS Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant < 482 °F (> 250 °C) (3.1.1-55)	Loss of fracture toughness due to thermal aging embrittlement	ISI (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, ISI requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	ISI	Consistent with GALL Report
Copper alloy greater than 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 Davis-Besse (see SER Section 3.1.2.1.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
CASS Class 1 piping, piping components, and piping elements and CRD pressure housings exposed to reactor coolant > 482 °F (> 250 °C) (3.1.1-57)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.1.1)
Steel RCPB external surfaces exposed to air with borated water leakage (3.1.1-58)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report (see SER Section 3.1.2.1.2)
Steel SG 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	Flow-Accelerated Corrosion	Consistent with GALL Report
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 Davis-Besse (see SER Section 3.1.2.1.1)
Stainless steel, steel pressurizer integral support exposed to air with metal temperature up to 550 °F (288°C) (3.1.1-61)	Cracking due to cyclic loading	ISI (IWB, IWC, and IWD)	No	ISI	Consistent with GALL Report
Stainless steel, steel with stainless steel cladding RCS cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant (3.1.1-62)	Cracking due to cyclic loading	ISI (IWB, IWC, and IWD)	No	ISI and PWR Reactor Vessel Internals 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 RV flange, stainless steel and nickel-alloy RVIs exposed to reactor coolant (e.g., upper and lower internals assembly, CEA shroud assembly, core support barrel, upper grid assembly, CSS assembly, lower grid assembly) (3.1.1-63)	Loss of material due to wear	ISI (IWB, IWC, and IWD)	No	PWR Reactor Vessel Internals Program	Consistent with GALL Report
Stainless steel and steel with stainless steel or nickel-alloy cladding pressurizer components (3.1.1-64)	Cracking due to SCC and PWSCC	ISI (IWB, IWC, and IWD) and Water Chemistry	No	ISI and PWR Water Chemistry	Consistent with GALL Report
Nickel-alloy RV upper head and CRD penetration nozzles, instrument tubes, head vent pipe (top head), and welds (3.1.1-65)	Cracking due to PWSCC	ISI (IWB, IWC, and IWD) and Water Chemistry and Nickel-Alloy Penetration Nozzles Welded to the Upper RV Closure Heads of PWRs	No	PWR Water Chemistry, Nickel-Alloy RV Closure Head Nozzle, and ISI	Consistent with GALL Report
Steel SG secondary manways and handholds (cover only) exposed to air with leaking secondary-side water or steam or both (3.1.1-66)	Loss of material due to erosion	ISI (IWB, IWC, and IWD) for Class 2 components	No	Not applicable	Not applicable to Davis-Besse (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	ISI (IWB, IWC, and IWD) and Water Chemistry	No	ISI	Consistent with GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel, steel with stainless steel cladding Class 1 piping, fittings, pump casings, valve bodies, nozzles, safe ends, manways, flanges, CRD housing; pressurizer heater sheaths, sleeves, diaphragm plate; pressurizer relief tank components, RCS cold leg, hot leg, surge line, and spray line piping and fittings (3.1.1-68)	Cracking due to SCC	ISI (IWB, IWC, and IWD) and Water Chemistry	No	ISI and PWR 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 SCC and PWSCC	ISI (IWB, IWC, and IWD) and Water Chemistry	No	ISI and PWR Water Chemistry	Consistent with GALL Report
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	ISI (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	ISI, PWR Water Chemistry, and Small Bore Class 1 Pipe Inspection	Consistent with GALL Report (see SER Section 3.1.2.1.3)
High-strength low alloy steel closure head stud assembly exposed to air with reactor coolant leakage (3.1.1-71)	Cracking due to SCC and loss of material due to wear	Reactor Head Closure Studs	No	Reactor Head Closure Studs	Consistent with GALL Report
Nickel-alloy SG tubes and sleeves exposed to secondary feedwater/steam (3.1.1-72)	Cracking due to outside-diameter SCC and IGA, loss of material due to fretting and wear	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity and PWR 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 SG tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-73)	Cracking due to PWSCC	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity and PWR Water Chemistry	Consistent with GALL Report
Chrome plated steel, stainless steel, nickel-alloy SG anti-vibration bars exposed to secondary feedwater/steam (3.1.1-74)	Cracking due to SCC, loss of material due to crevice corrosion and fretting	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.1.1)
Nickel-alloy OTSG 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 and Water Chemistry	Consistent with GALL Report
Steel SG tube support plate, tube bundle wrapper exposed to secondary feedwater/steam (3.1.1-76)	Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity and Water Chemistry	Consistent with GALL Report
Nickel-alloy SG 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 Davis-Besse (see SER Section 3.1.2.1.1))
Steel SG 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 Davis-Besse (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 SG 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 Davis-Besse (see SER Section 3.1.2.1.1)
CASSRVIs (e.g., upper internals assembly, lower internal assembly, CEA shroud assemblies, CRGT assembly, CSS 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	PWR Reactor Vessel Internals Program	Consistent with GALL Report (see SER Section 3.1.2.1.4)
Nickel-alloy or nickel-alloy clad SG divider plate exposed to reactor coolant (3.1.1-81)	Cracking due to PWSCC	Water Chemistry	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.1.1)
Stainless steel SG primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy RVIs and RCPB components exposed to reactor coolant (3.1.1-83)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	PWR 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 SG components, such as secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater/steam (3.1.1-84)	Cracking due to SCC	Water Chemistry and One-Time Inspection or ISI (IWB, IWC, and IWD)	No	PWR Water Chemistry and ISI	Consistent with GALL Report
Nickel-alloy piping, piping components, and piping elements exposed to air-indoor uncontrolled (external) (3.1.1-85)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (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	Not applicable	None	Consistent with GALL Report
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (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.

As a result of Revision 2 to the SRP-LR and the GALL Report, there was a significant realignment of AMR items as follows:

- In some cases, changes were of an administrative nature (e.g., an identical material, environment, aging effect, and recommended program in Table 3.1-1of the SRP-LR was renumbered with no other changes).
- Technical changes were implemented for specific Table 3.1-1 items (e.g., component information clarified, changes to environment, added concrete attributes evaluation, clarified boiling water reactor (BWR) and PWR applicability).
- Many SRP-LR further evaluation recommendations were eliminated, principally because Revision 2 implemented changes to GALL Report AMPs and AMR items resulting in the further evaluation being addressed. As an example, Revision 1 of the SRP-LR and GALL Report recommended a further evaluation of a plant-specific program to manage hardening and loss of strength of elastomeric components exposed to air-indoor uncontrolled. Revision 2 of the SRP-LR and GALL Report incorporated elastomeric components, including visual exams and manipulation of the material into GALL Report AMPs XI.M36, "External Surfaces Monitoring of Mechanical Components" and XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," thus eliminating the need for a plant-specific program.
- Revision 2 contains additional material, environment, and aging effect combinations, thus eliminating the need for citing generic notes F–J given that the applicant could now select a Table 3.1-1 that is consistent. For example AMR item 3.4-53, which addresses copper-alloy (less than or equal to 15 percent Zn and less than or equal to 8 percent Al) piping, piping components, and piping elements exposed to air with borated water leakage, was added.

In each instance, regardless of the type of change, the staff evaluated the Revision 1 technical requirements compared to the Revision 2 technical requirements and ensured that the applicant's LRA was evaluated against the current staff position as contained in Revision 2.

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 RV, RVIs, and RCS components:

- Bolting Integrity Program
- Closed Cooling Water Chemistry Program
- Boric Acid Corrosion Program
- Fatigue Monitoring Program (fatigue TLAAs)
- Flow-Accelerated Corrosion Program
- ISI Program
- Lubricating Oil Analysis Program
- Nickel-Alloy Management Program
- Nickel-Alloy Reactor Vessel Closure Head Nozzles Program
- One-Time Inspection Program
- PWR Reactor Vessel Internals Program
- PWR Water Chemistry Program
- Reactor Head Closure Studs Program
- RV Surveillance Program
- Small Bore Class 1 Piping Inspection Program
- Steam Generator Tube Integrity Program

LRA Tables 3.1.2-1 through 3.1.2-4 summarize the results of AMRs for the RPV, RVIs, RCS and RCPB, and SG 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 if the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR item describing how the information in the tables aligns with the information in the GALL Report. The staff reviewed those AMRs with notes A–E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff reviewed these AMR 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 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 AMR items to verify consistency with the GALL Report and ensure that the applicant reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from, 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 AMR items to verify consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR item, although different from, 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 AMR items to verify consistency with the GALL Report. The staff confirmed whether the AMR 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 item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff reviewed these 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 identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

The staff reviewed the LRA to confirm that the applicant did the following:

- provided a brief description of the system, components, materials, and environments
- stated that the applicable aging effects were reviewed and evaluated in the GALL Report
- identified those aging effects for the RCS, RCPB, RV, RVIs, and SG 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

For items 3.1.1-1 through 3.1.1-4, 3.1.1-11, 3.1.1-13 through 3.1.1-15, 3.1.1-19. 3.1.1-20, 3.1.1-25, 3.1.1-26, 3.1.1-29, and 3.1.1-38 through 3.1.1-51 in LRA Table 3.1.1, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR, confirmed these items only apply to BWRs, and finds these items are not applicable to Davis-Besse.

For items 3.1.1-53, 3.1.1-54, 3.1.1-56, 3.1.1-57, 3.1.1-66, 3.1.181, 3.1.1-82, and 3.1.1-87 in LRA Table 3.1.1, the applicant claimed that they were not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Davis-Besse. The staff reviewed the LRA and USAR and confirmed that the applicant's LRA does not have any AMR results that are applicable to these items.

For LRA Table 3.1.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable; however, the staff non-applicability verification of these items required the review of sources beyond the LRA and FSAR, and/or the issuance of RAIs.

LRA Table 3.1.1, item 3.1.1-60, addresses stainless steel flux thimble tubes (with or without chrome plating) exposed to reactor coolant and subject to loss of material due to wear. The applicant stated that this item is not applicable because the RPV and RVI components were not fabricated by Westinghouse Electric Company. Instead, the applicant stated that the RPV and RVI components were fabricated by B&W Company; therefore, the referenced GALL Report AMR item is not applicable to the design of the Davis-Besse RPV and RVI components.

The staff reviewed the applicant's basis against relevant information in the GALL Report and Davis-Besse USAR. The staff confirmed that AMR item 3.1.1-60, in Table 1 of the GALL Report, Volume 1 and AMR item IV.B2-13 in the GALL Report, Volume 2 are only applicable to the management of loss of material due to wear in Westinghouse-design flux thimble tubes. The staff also confirmed that the Davis-Besse RPV and RVI components vessel internals were fabricated by B&W, and the RVI components do not include movable flux thimble tubes. Therefore, the staff concludes that the applicant provided an acceptable basis for concluding that the referenced GALL AMR items are not applicable to the LRA because the staff confirmed that Davis-Besse is not designed with incore flux thimble tubes.

LRA Table 3.1.1, item 3.1.1-74, addresses chrome plated steel, stainless steel, nickel-alloy SG anti-vibration bars exposed to secondary feedwater and steam. The applicant stated that this item is not applicable because its plant has OTSGs, and the item applies only to recirculating SGs. The staff reviewed the USAR to verify the type of SG used by the plant. Based on the information in the USAR, the staff confirmed that the applicant's plant has OTSGs; therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-77, addresses nickel-alloy SG tubes and sleeves exposed to phosphate chemistry in the secondary feedwater system. The applicant stated that this item is not applicable because its plant does not use phosphate chemistry in the SGs. The staff reviewed the USAR to verify that phosphate chemistry was not used in the SGs at the plant. Based on the information in the USAR, the staff confirmed that the applicant's plant does not use phosphate chemistry in the SGs; therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-78, addresses steel SG tube support lattice bars exposed to the secondary feedwater steam. The applicant stated that this item is not applicable because its plant has tube support plates rather than lattice bars. The staff reviewed the USAR to verify the design of the applicant's SGs. Based on the information in the USAR, the staff confirmed that the applicant's SGs do not have tube support lattice bars; therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-79, addresses nickel-alloy SG tubes exposed to secondary feedwater and steam. The specific aging mechanism for this item is denting of SG tubes due to corrosion of the steel tube support plate. The applicant stated that this item is not applicable and that denting of SG tubes is addressed in item 3.1.1-75. Item 3.1.1-75 addresses denting, due to corrosion of carbon steel tube support plates, of nickel-alloy OTSG tubes exposed to secondary feedwater and steam. Based on the information in the USAR, the staff confirmed that the applicant's SGs are OTSGs; therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-85, addresses nickel-alloy piping, piping components, and piping elements exposed to air-indoor uncontrolled (external). The GALL Report recommends, in item IV.E-1 of Table IV.E, "Reactor Vessel, Internals, and Reactor Coolant System; Common Miscellaneous Material Environmental Combinations," that there is no aging effect or mechanism and no program is necessary to manage nickel-alloy materials in air-indoor uncontrolled (external) for this component group. The applicant stated that this item is not applicable because each component has the harsher environment of air with borated water leakage. The staff evaluated the applicant's claim and found it acceptable because it is in compliance with the GALL Report recommendations. The staff reviewed the associated items in the LRA and confirmed that this aging effect(s) is not applicable for this component, material, and environmental combination based on its review of the GALL Report, which states that there is no aging effect mechanism, and no AMP is required. Therefore, the staff finds the applicant's determination acceptable.

3.1.2.1.2 Loss of Material Due to Boric Acid Corrosion

LRA Table 3.1.1, item 3.1.1-58, addresses steel RCPB external surfaces exposed to air with borated water leakage, which are being managed for loss of material due to boric acid corrosion. In its review of components associated with item 3.1.1-58, for which the applicant cited generic note A, the staff noted that the GALL Report, item IV.A2-13, recommends GALL

Report AMP XI.M10, "Boric Acid Corrosion," for managing the aging effect. The staff also noted that the applicant's Boric Acid Corrosion Program does not include evaluations and assessments when leakage is discovered in the upper head reactor dome. It is unclear what methods the applicant plans to use to assess integrity of the upper dome when leakage is discovered in the upper dome of the PWR. By letter dated May 2, 2011, the staff issued RAI 3.1.2.1.58-1 requesting that the applicant provide information regarding the methods to be used to assess the integrity of the upper dome when leakage is discovered in the upper dome of the PWR.

In its response dated June 3, 2011, the applicant stated that evaluations and repair activities associated with the upper head reactor dome are included in the Nickel-Alloy Reactor Vessel Closure Head Nozzle Program, which performs inspections in accordance with ASME Code Case N-729-1. The applicant revised LRA Table 3.1.2-1, row 99, to include plant-specific note 0113 that references the use of the Nickel-Alloy Reactor Vessel Closure Head Nozzle Program.

The staff finds the applicant's response acceptable because the inspections associated with ASME Code Case N-729-1, in addition to periodic inspections in the Boric Acid Corrosion Program, are capable of ensuring the that deterioration of the upper vessel head will be detected prior to loss of intended function. The staff's concern described in RAI 3.1.2.1.58-1 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.1.3 Cracking due to Stress Corrosion Cracking

LRA Table 3.1.1, item 3.1.1-70, addresses stainless steel Class 1 piping, fittings, and branch connections less than 4 in. NPS exposed to reactor coolant, which are being managed for cracking due to flaw growth, SCC, and IGA. In its review of components associated with LRA item 3.1.1-70, for which the applicant cited generic note A, the staff noted that the applicant is managing cracking due to flaw growth, SCC, and IGA of CASS and stainless steel valve bodies less than 4 in. with the ISI Program, PWR Water Chemistry Program, and Small Bore Class 1 Piping Inspection Program. The scope of the applicant's Small Bore Class 1 Piping Inspection Program, described in LRA Section B.2.37, includes small bore ASME Code Class 1 piping less than 4 in. NPS, which includes pipe, fittings, and branch connections; however, it does not include valve bodies. Therefore, the staff noted that the applicant's AMR results that credit the Small Bore Class 1 Piping Inspection Program for the valve bodies is not consistent with the scope of the program.

By letter dated May 2, 2011, the staff issued RAI 3.1.1.70-1 requesting that the applicant clarify why the Small Bore Class 1 Piping Inspection Program is credited to manage cracking due to flaw growth, SCC, and IGA of the stainless steel and CASS valve bodies less than 4 inches, when this program only includes small-bore piping, fitting, and branch connections. In addition, the applicant was requested to clarify how this program will manage this aging effect specific to stainless steel and CASS valve bodies less than 4 inches.

In its response dated June 3, 2011, the applicant stated that the Small Bore Class 1 Piping Inspection Program is credited to manage cracking due to flaw growth, SCC, and IGA of stainless steel and CASS valve bodies less than 4 inch NPS. The applicant stated that stainless steel and CASS valve bodies are included in LRA Table 3.1.1, item 3.1.1-70, under the category of piping, fittings, and branch connections for piping less than 4 in. NPS. The applicant also stated that the Small Bore Class 1 Piping Inspection Program will be designed to detect cracking of small bore ASME Code Class 1 piping less than 4 inch NPS and greater than or equal to 1 in. NPS, which includes pipe, fittings, and branch connections.

The staff finds the applicant's response not acceptable because the applicant did not clearly describe how the Small Bore Class 1 Piping Inspection Program would be used to manage cracking of the valve bodies even though the applicant proposed using the program to manage the aging effect. Therefore, the staff held a conference call with the applicant on June 15, 2011, to discuss the RAI response. By letter dated June 24, 2011, the applicant submitted a revised response to RAI 3.1.1.70-1 based on the discussion made during the teleconference call.

In its response dated June 24, 2011, the applicant stated that the scope of the Small Bore Class 1 Piping Inspection Program includes pipe, fittings, and branch connections and all full and partial penetration (socket) welds, and it does not include valve bodies. The applicant also revised LRA Table 3.1.2-3 to show that the Small Bore Class 1 Piping Inspection Program will not be credited for the aging management of cracking of small bore valve bodies less than 4 inches.

Based on its review, the staff finds the applicant's response, as amended by letter dated June 24, 2011, acceptable because the applicant confirmed that the Small Bore Class 1 Piping Inspection Program is not credited to manage cracking of valve bodies less than 4 inches, consistent with the scope of the applicant's program. Additionally, the applicant's proposal to manage the aging effect of the stainless steel valve bodies is consistent with GALL Report, Revision 2, item, IV.C2.R-09, which recommends GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" and AMP XI.M2, "Water Chemistry." The staff's concern described in RAI 3.1.1.70-1 is resolved.

The staff's evaluations of the applicant's PWR Water Chemistry Program, ISI Program, and Small Bore Class 1 Piping Inspection Program are documented in SER Sections 3.0.3.1.15, 3.0.3.1.12, and 3.0.3.1.17, respectively. In its review of components associated with item 3.1.1-70, the staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program, ISI Program, and Small Bore Class 1 Piping Inspection Program acceptable for the following reasons:

- The PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and includes the actions that will be performed if the parameters exceed the limits.
- The ISI Program includes visual and surface inspections as required by the ASME Code Section XI such that the effects of aging due to SCC are detected and managed in a consistent manner with the GALL Report.
- The Small Bore Class 1 Piping Inspection Program includes volumetric examinations of small-bore pipe, fittings, and branch connections, which are adequate to detect and manage cracking due to SCC of the small-bore components, consistent with the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.1.4 Reduction of Fracture Toughness

LRA Table 3.1.2, item 3.1.1-80, addresses CASS RVIs (upper internals assembly, lower internal assembly, control element assembly (CEA) shroud assemblies, CRGT assembly, CSS assembly, and lower grid assembly) exposed to borated reactor coolant with neutron fluence (internal), which are being managed for reduction of fracture toughness due to thermal aging and neutron irradiation embrittlement. The LRA credits the PWR Reactor Vessel Internals Program to manage the aging effect for the components. The associated AMR items in LRA Table 3.1.2-2 cites generic note E.

For those items associated with generic note E, GALL Report, Revision 2, recommends AMP XI.M16A, “PWR Vessel Internals Program.” In its review of the components, which are associated with LRA item 3.1.1-80, for which the applicant cited generic note E, the staff noted that the PWR Reactor Vessel Internals Program proposes to manage the aging of the CASS components through the examinations based on the guidance described in MRP-227, Revision 0, and the implementation guidance described in NEI 03-08.

LRA Table 3.1.2-2 addresses reduction of fracture toughness due to thermal aging and neutron irradiation embrittlement of the CASS RVI plenum cylinder reinforcing plate exposed to borated reactor coolant with neutron fluence and references LRA Table 1, item 3.1.1-80, and GALL Report, Revision 1, item IV.B4-4. LRA Table 3.1.2-2 also indicates that the aging effect of the component is managed by the PWR Vessel Internals Program. However, the staff noted that MRP-227, Revision 0, Tables 3-1, 4-1 and 4-4, do not specifically address the reduction in fracture toughness of the CASS plenum cylinder reinforcing plate. Therefore, the staff found a need for further clarification as to how the applicant’s program will manage the aging effect of the CASS plenum cylinder reinforcing plate. By letter dated May 2, 2011, the staff issued RAI 3.1.2.2-1 requesting that the applicant describe and justify how the CASS plenum cylinder reinforcing plate will be managed for reduction in fracture toughness by the PWR Vessel Internals Program.

In its response dated June 3, 2011, the applicant stated that reduction in fracture toughness of the CASS plenum cylinder reinforcing plate will be managed indirectly by inspection techniques of the PWR Reactor Vessel Internals Program as applied to the most susceptible components, in accordance with MRP-227. The applicant also stated that the plenum cylinder reinforcing plate is neither identified in MRP-227 as requiring further evaluation nor requiring plant-specific analysis, which implies that no specific examination or analysis of this component will be performed. In addition, general visual examinations of the internals, including the plenum cylinder, will be relied upon to identify any problems with the plenum cylinder reinforcing plates. However, the staff noted that the applicant did not clearly address what the inspection frequency of the plenum cylinder reinforcing plates is in the applicant’s program. Therefore, by letter dated June 21, 2011, the staff issued RAI 3.1.2.2-2 requesting that the applicant describe the inspection frequency of the CASS plenum cylinder reinforcing plates and the technical basis for the inspection frequency. The staff also requested other additional information in RAI 3.1.2.2-2 as further described below.

LRA Table 3.1.2-2 addresses CASS RVI components subject to reduction in fracture toughness, which is managed by the PWR Reactor Vessel Internals Program. These CASS components are as follows:

- incore guide tube assembly spider in the core support assembly (CSA)
- plenum CRGT spacer casting

- CSA vent valve assembly valve body
- plenum cylinder reinforcing plate

In comparison, GALL Report, Revision 2, and MRP-227, Revision 0, Tables 3-1, 4-1 and 4-4, indicate that the following B&W plant CASS RVI components are managed for loss of fracture toughness:

- CSS cast outlet nozzles
- CSS vent valve discs
- IMI guide tube spiders (accessible top surfaces)
- CRGT spacer castings

The staff noted that LRA Table 3.1.2-2 does not clearly indicate that CSS outlet nozzles and vent valve discs are made of CASS. The staff also noted that in contrast with MRP-227, Revision 0, LRA Table 3.1.2-2 does not clearly identify the functional groups and link relationships for CSS outlet nozzles, CSS vent valve discs, incore guide tube assembly spiders, and CRGT spacer castings. The staff further noted that the LRA does not clearly describe the inspection method and frequency of the CSA vent valve body and their technical basis although the LRA indicates that the CASS CSA vent valve body is subject to reduction in fracture toughness.

- By letter dated June 21, 2011, the staff issued RAI 3.1.2.2-2 requesting that the applicant do the following: describe the functional groups for the CSA vent valve body and plenum cylinder reinforcing plate addressed in LRA Table 3.1.2-2 and, if existent, describe their link relationships with other components
- describe the inspection method, including its frequency, of the CSA vent valve body and plenum cylinder reinforcing plate and provide the technical basis for the assigned component groups, link relationships, and inspection method/frequency of the components
- clarify whether or not the CSS outlet nozzles and CSS vent valve discs are made of CASS material
- describe the functional groups and link relationships for the CSS outlet nozzles, CSS vent valve discs, IMI guide tube assembly spiders, and CRGT spacer castings to confirm their consistency with MRP-227
- revise LRA Table 3.1.2-2 and other related information in the LRA, consistent with the response to RAI 3.1.2.2-2

In its response dated July 22, 2011, the applicant revised LRA Table 3.1.2-2 and stated that in MRP-227, the reactor internals were assigned to one of the following four functional groups: primary, expansion, existing programs, and no additional measures components. The applicant indicated that the link relationships in the revised LRA are consistent with MRP-227 Tables 4-1 and 4-4 along with the inspection frequency and method. However, the staff noted that the MRP-227 Tables 4-1 and 4-4 do not clearly address functional groups link relationships or inspection method, including the frequency, specified for the CSA vent valve body and plenum cylinder reinforcing plate. In addition, the staff noted that the revised LRA Table 3.1.2-2 does not address the following GALL Report, Revision 2, items: (1) IV.B4.RP-236 and IV.B4.RP-237 for the components with no additional measures, (2) IV.B4.RP-238 and IV.B4.RP-239 that address aging effects of the inaccessible locations of the RVIs, and (3) IV.B4.RP-382 that recommends GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," to manage cracking or loss of material of core support structure. Therefore, by letter dated August 11, 2011, the staff issued RAI 3.1.2.2-3 requesting that the applicant provide justification as to why LRA Table 3.1.2-2 does not include an AMR item that addresses GALL Report items IV.B4.RP-236, IV.B4.RP-237, IV.B4.RP-238, IV.B4.RP-239 or IV.B4.RP-382. The staff also requested that the applicant provide justification as to why LRA Table 3.1.2-2 does not address an AMR item to manage reduction in fracture toughness of the CASS vent valve body even though applicant's TS require visual inspections of the component to ensure no abnormal degradation, and Topical Report BAW-2248A indicates that reduction in facture toughness is applicable to the internal valve bodies. In addition, the staff requested the applicant provide the following information: the functional groups, the link relationships (if existent), and the inspection method, including the frequency used to manage reduction in fracture toughness of the CSA vent valve body and plenum cylinder reinforcing plate.

In its response dated September 16, 2011, the applicant stated that LRA Table 3.1.2-2 is revised to include GALL Report items IV.B4.RP-236, IV.B4.RP-237, IV.B4.RP-238, and IV.B4.RP-239. The applicant also indicated that LRA Table 3.1.2-2 is revised to include GALL Report item IV.B4.RP-382 and that as part of the ISI Program, a visual (VT-3) examination of the RV removable core support structure accessible surfaces is conducted once per ISI interval in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-N-3. The applicant stated that the accessible surfaces of the plenum cylinder reinforcing plate and vent valve body are included in this inspection, and the results of these inspections have not identified any unacceptable indication. The applicant also indicated that as part of the development of the MRP-227 program, the CASS RVI components were initially screened based on casting method, percent ferrite, and molybdenum content to determine if the components were susceptible to thermal aging embrittlement. The applicant further stated that MRP-189-Revision 1 provides the results of this screening, and as documented in MRP-189-Revision 1, the vent valve body was deemed not to be susceptible to any of the eight age-related degradation mechanisms (including loss of fracture toughness due to thermal embrittlement) and, therefore, was categorized as "A" (i.e., below the screening criteria of the age-related degradation mechanisms considered by the MRP-227 Program); therefore, "no additional measures" were needed for this component.

The applicant also indicated that TS 5.5.4 requires testing of the vent valve to verify by visual inspection that the valve body and valve disc exhibit no abnormal degradation and the valve is not stuck in an open position, and to verify by manual actuation that the valve is fully open when a force equal or less than 400 lbs is applied vertically upward. This testing with inspections is not credited by MRP-227 for managing loss of fracture toughness of the vent valve body. Furthermore, the applicant indicated that BAW-2248A only identified potential aging effects and did not perform screening based on casting method, percent ferrite, and molybdenum content to determine if the components were susceptible to thermal aging embrittlement. The applicant indicated that two plenum cylinder reinforcing plates were identified and each had a ferrite content below the 20 percent screening value for thermal aging embrittlement of CF-8 casting. The applicant also indicated that the components are placed in the Category "A" items in the MRP-227 screening process and thus no additional inspection requirements or evaluations are needed for this component.

In its response dated July 22, 2011, the applicant clarified that the CSS outlet nozzles and CSS vent valve discs are made of CASS. The applicant also revised LRA Table 3.1.2-2 to provide detailed information as to the functional groups and link relationships for the CSS outlet nozzles, CSS vent valve discs, IMI guide tube assembly spiders and CRGT spacer castings. By letter dated March 9, 2012, the applicant further supplemented its previous responses. The applicant indicated that its supplemental response provides necessary updates for the RVIs AMR results and the PWR Reactor Vessel Internals Program based on a review of MRP-227-A dated December 2011 against the previous version of MRP-227 dated December 2008. In its review, the staff finds that this supplemental revision to LRA Table 3.1.2-2 confirms that the functional groups and link relationships of the CASS components are consistent with MRP-227-A; therefore, it is acceptable.

Based on its review the staff finds the applicant's response acceptable because :

- The AMR items for the CASS RVI components in the revised LRA Table 3.1.2-2 are consistent with MRP-227-A.
- LRA Table 3.1.2-2 is revised to include AMR items that address no additional measures components, aging management of inaccessible locations, and aging management crediting the inspections per the ASME Code Section XI requirements.
- The applicant provided technical basis as to why LRA Table 3.1.2-2 does not include an AMR item that addresses reduction in fracture toughness of the CASS vent valve body and plenum cylinder reinforcing plate.
- The applicant's screening results for reduction in fracture toughness determine that the vent valve body and plenum cylinder reinforcing plate were screened below the screening criteria and no additional measures are required for these components.
- The applicant's criteria used to screen these CASS components is consistent with the guidance in the GALL Report.
- The applicant confirmed that a visual (VT-3) examination of the removable core support structure is conducted once per inservice inspection interval in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-N-3, and the accessible surfaces of the plenum cylinder reinforcing plate and vent valve body are included in this inspection.
- The applicant also confirmed that the results of these inspections have not identified any unacceptable indication.

On the basis of its review, the staff's concerns described in RAIs 3.1.2.2-1, 3.1.2.2-2 and 3.1.2.2-3 are resolved.

The staff's evaluation of the applicant's PWR Reactor Vessel Internals Program is documented in SER Section 3.0.3.3.6. In its review of components associated with item 3.1.1-80, the staff finds the applicant's proposal to manage aging using the PWR Reactor Vessel Internals Program acceptable because the applicant's program includes component screening and visual examinations of the CASS components in a consistent manner with the guidance in MRP-227, which is adequate to manage this aging effect.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

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 SCC and intergranular SCC (IGSCC)
- 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 IASCC
- cracking due to PWSCC
- wall thinning due to flow-accelerated corrosion
- changes in dimensions due to void swelling
- cracking due to SCC and PWSCC
- cracking due to SCC, PWSCC, and IASCC
- 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 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 addresses the applicant's AMR basis for managing cumulative fatigue damage in ASME Code Class 1 components and other non-Class 1 components that were analyzed to ASME Code Section III, Class 1 fatigue evaluations. The applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3, and these TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). Further evaluation of these TLAAs is discussed separately in LRA Section 4.3.

The staff confirmed that LRA Table 3.1.1, items 3.1.1-1 through 3.1.1-4, reference components that are only applicable to BWR-designed plants and that the applicant identified LRA Table 3.1.1, items 3.1.1-5 through item 3.1.1-10, as being applicable to its PWR-designed plant.

The staff reviewed LRA Section 3.1.2.2.1 against the further evaluation criteria in SRP-LR Section 3.1.2.2.1, which state that fatigue is a TLAA, as defined in 10 CFR 54.3, and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements in 10 CFR 54.21(c)(1) and in accordance with SRP-LR Section 4.3, "Metal Fatigue Analysis." The staff also reviewed LRA Section 3.1.2.2.1 and the AMRs items and found that the AMR results are consistent with the GALL Report and SRP-LR except for the area identified below.

In its review of components associated with item 3.1.1-6, the staff noted that the applicant is crediting TLAA to manage fatigue of the following components on the SG secondary side: AFW pumps thermal sleeve and header transition section and the main feedwater (MFW) spray head. However, LRA Section 4.3 did not identify results or provided a discussion of the associated TLAAs. The staff also identified similar issues for the steel pressurizer support plate assembly and the following SG secondary side components: MFW header support plate and gusset, MFW header, and the piping cap. By letter dated April 20, 2011, the staff issued RAI 3.1.2.2.1-1 requesting that the applicant clarify which TLAAs in the LRA are being credited to manage the cumulative fatigue damage of these components or justify why their TLAA was not identified and dispositioned in accordance with 10 CFR 54.21(c)(1).

In its response dated June 3, 2011, the applicant stated that, except for the pressurizer support plate assembly, the subject AMR items were included with the fatigue TLAA discussion in LRA Section 4.3. For the pressurizer support plate assembly, the applicant stated that there was no specific fatigue analysis for this component, it was not part of the RCPB, and it will delete the AMR item associated with this component that references a TLAA. The staff confirmed, in LRA Table 2.3.1-3, that the intended function of the pressurizer support plate assembly is support only. In the response to RAI 3.1.2.2.1-1, the applicant stated that the SG AFW thermal sleeve and header transition pieces are part of the OTSG AFW modification discussed in LRA Section 4.3.2.2.6.3. The applicant also stated that the MFW header support plate and gusset are attached to the secondary side of the inside OTSG shell, and they were included as part of the evaluation in LRA Section 4.3.2.2.6.1. For the SG secondary side MFW spray head, header, and pipe caps, the applicant stated that these components were designed to ANSI B31.1, and the TLAA disposition was included in LRA Section 4.3.3.1.

On the basis of its review, the staff finds the applicant's response to RAI 3.1.2.2.1-1 acceptable for the following reasons:

- The applicant clarified the TLAAs in the LRA that are credited by the AMR items for the OTSG identified above.
- The applicant amended LRA Table 3.1.2-3 to remove the AMR item for the pressurizer support plate assembly that incorrectly credited a TLAA for managing fatigue.
- The applicant's AMR results are consistent with the recommendations of the GALL Report.

The staff's review of the applicant's TLAAs associated with the OTSG and ANSI B31.1 components is documented in SER Section 4.3. The staff's concern described in RAI 3.1.2.2.1-1 is resolved.

On the basis of its review, the staff concludes that the applicant meets the SRP-LR Section 3.1.2.2.1 criteria. For those items that apply to LRA Section 3.1.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3 documents the staff's review of the applicant's evaluation of the TLAA for these components.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the following criteria in SRP-LR Section 3.1.2.2.2:

(1) LRA Section 3.1.2.2.2.1, associated with LRA Table 3.1.1, item 3.1.1-12, addresses the steel PWR SG shell assembly exposed to secondary feedwater and steam. The identified aging effects for these components are the loss of material due to general, pitting, and crevice corrosion, which are being managed by the PWR Water Chemistry Program, including the one-time inspection of these components, as stated in LRA Section 3.1.2.2.2.1. The staff reviewed LRA Section 3.1.2.2.2.1 against criteria in SRP-LR 3.1.2.2.2, item 1. The criteria in SRP-LR Section 3.1.2.2.2, item 1, state that loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR SG shell assembly exposed to secondary feedwater and steam. The SRP-LR also states that the existing program relies on control of reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude the loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. Accordingly, The SRP-LR states that 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 applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to general, pitting, and crevice corrosion for the Davis-Besse PWR SG shell assemblies that are exposed to secondary feedwater and steam is managed by the PWR Water Chemistry Program, which manages loss of material through periodic monitoring and control of contaminants. The applicant also stated that the One-Time Inspection Program will provide verification of the effectiveness of the PWR Water Chemistry Program to manage loss of material.

The staff's evaluations of the applicant's PWR Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.1.1-12, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry Program and the One-Time Inspection Program is acceptable. The PWR Water Chemistry Program minimizes the concentration of contaminants that contribute to general, pitting, and crevice corrosion, and the One-Time Inspection Program of the SG shell assembly components provides an acceptable method for verifying the effectiveness of the applicant's PWR Water Chemistry Program in preventing or mitigating general, pitting, and crevice corrosion for the Davis-Besse PWR SG shell assemblies that are exposed to secondary feedwater and steam.

(2) SRP-LR Section 3.1.2.2.2.2 refers to Table 3.1.1, item 3.1.1-13, which applies to BWR isolation condenser components and is not applicable to Davis-Besse, which is a PWR.

(3) SRP-LR Section 3.1.2.2.2.3 refers to Table 3.1.1, items 3.1.1-14 and 3.1.1-15, which apply to BWR RV and RCPB components and are not applicable to Davis-Besse, which is a PWR.

(4) LRA Section 3.1.2.2.2.4, associated with Table 3.1.1, item 3.1.1-16, addresses the steel PWR SG upper and lower shell and transition cone exposed to secondary feedwater and steam. Aging management for these items is provided by the ISI Program for the ASME Code, Section XI, Subsections IWB, IWC, and IWD, and the PWR Water Chemistry Program. The GALL Report recommends augmented inspection beyond the requirements of the ISI Program to manage loss of material due to general, pitting, and crevice corrosion for this component group. Furthermore, the GALL Report clarifies that the need for augmented inspection is limited to Westinghouse Model 44 and 51 SGs where a high stress region exists at the shell to transition cone weld. The applicant stated, in LRA Section 3.1.2.2.2.4, that this item is not applicable because Davis-Besse does not have Westinghouse Model 44 and 51 SGs. The staff evaluated the applicant's claim and found it acceptable because the staff reviewed USAR Section 5.0 and confirmed that Davis-Besse does not have Westinghouse Model 44 or 51 SGs.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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 3.1.2.2.3.1, associated with LRA Table 3.1.1, item 3.1.1-17, states that, for ferritic materials with projected neutron fluence greater than $1x10^{17}$ n/cm^2 (E greater than 1.0 MeV), certain aspects of neutron irradiation embrittlement are TLAAs, as defined in 10 CFR 54.3. LRA Section 3.1.2.2.3.1 also states that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c) and that the evaluation of this TLAA is addressed in LRA Section 4.2. This is consistent with SRP-LR Section 3.1.2.2.3, item 1, and is, therefore, acceptable. SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA.

(2) LRA Section 3.1.2.2.3.2, associated with LRA Table 3.1.1, item 3.1.1-18, addresses steel (with stainless steel cladding) RV beltline shell, nozzles, and welds exposed to borated reactor coolant with neutron fluence, which are being managed for loss of fracture toughness due to neutron irradiation embrittlement by the RV Surveillance Program. The criteria in SRP-LR Section 3.1.2.2.3, item 2, state that loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR RV beltline shells, nozzles, and welds exposed to reactor coolant and neutron flux. The SRP-LR also states that a RV materials surveillance program monitors neutron irradiation embrittlement of the RV. The SRP-LR further states that RV surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. Additionally, the SRP-LR states that, in accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation, and untested capsules placed in storage must be maintained for future insertion. For these reasons, the SRP-LR states that further staff evaluation is required for license renewal and that specific recommendations for an acceptable program are

provided in Chapter XI, Section M31 of the GALL Report. The applicant addressed the further evaluation criteria of the SRP-LR by stating that a RV materials surveillance program manages radiation embrittlement of the RV beltline materials. The Davis-Besse RV Surveillance Program and the results of its evaluation for license renewal are presented in LRA Appendix B, Section B.2.35.

The staff's evaluation of the applicant's RV Surveillance Program is documented in SER Section 3.0.3.2.14. In its review of components associated with item 3.1.1-18, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage aging using the RV Surveillance Program is acceptable because the RV Surveillance Program is consistent, with enhancement, with the GALL Report and the SRP-LR. Additionally, the RV Surveillance Program meets the SRP-LR Section 3.1.2.2.3, item 2, criteria because the surveillance program is based on the MIRVSP, described in NRC-staff approved topical report BAW-1543 (NP), "Master Integrated Reactor Vessel Surveillance Program," Revision 4, which contains a withdrawal schedule applicable to Davis-Besse. The Davis-Besse RV Surveillance Program has an untested capsule that will be scheduled for testing, but it does not have any capsules maintained in storage long-term; therefore, the SRP-LR criterion that "the program requires that any untested surveillance capsules placed in storage must be maintained for future insertion" is not applicable.

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 AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.4 against the criteria in SRP-LR Section 3.1.2.2.4:

(1) LRA Section 3.1.2.2.4, associated with LRA Table 3.1.1, item 3.1.1-19, addresses cracking due to SCC and IGSCC, stating that this aging effect is applicable to BWR plants only.

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 Davis-Besse because it 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, associated with LRA Table 3.1.1, item 3.1.1-20, addresses cracking due to SCC and IGSCC, stating that this aging effect is applicable to BWR plants only.

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 Davis-Besse because it is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWR-designed reactors.

Based on the information above, the staff concludes that the criteria in SRP-LR Section 3.1.2.2.4 do not apply.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5, associated with LRA Table 3.1.1, item 3.1.1-21, states that crack growth due to cyclic loading (i.e., underclad cracking) in SA-508, Class 2 RV forgings is a TLAA as defined in 10 CFR 54.3. LRA Section 3.1.2.2.5 also states that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c) and that the evaluation of this TLAA is addressed in LRA Section 4.2. This is consistent with SRP-LR Section 3.1.2.2.5 and is, therefore, acceptable. SER Section 4.2.6 documents the staff's review of the applicant's evaluation of this TLAA.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

LRA Section 3.1.2.2.6, associated with Table 3.1.1, item 3.1.1-22, addresses loss of fracture toughness due to neutron irradiation embrittlement and void swelling. The staff reviewed LRA Section 3.1.2.2.6 against criteria in SRP-LR 3.1.2.2.6, which recommends no further AMR if the applicant provides a commitment in the USAR supplement to do the following: (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 commitment in the USAR supplement related to aging management of the RVI. The staff noted that Commitment No. 14 requires the implementation of the PWR Reactor Vessel Internals AMP, as described in LRA Section B.2.32, upon entering the period of extended operation. LRA Section B.2.32 requires participation in industry programs for investigating and managing aging effects on the RVI, as well as evaluation and implementation of the results of industry programs as applicable to the RVI. Therefore, the staff determined that Commitment No. 14 satisfies items (1) and (2) from SRP-LR Section 3.1.2.2.6. The industry programs for investigating and managing aging effects on PWR Reactor Vessel Internals are provided in EPRI MRP Topical Report 1016596 (MRP-227), Revision 0, "Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines." By letter dated December 16, 2011, the staff issued Revision 1 of its final SE for MRP-227, Revision 0, wherein the staff concluded that MRP-227, Revision 0 is acceptable for referencing as the basis for PWR RVI AMPs in LRAs to the extent specified in the SE. Section 4.0 of the staff's SE for MRP-227, Revision 0 identified conditions, limitations, and license renewal applicant action items associated with MRP-227 implementation. The NRC-approved version of MRP-227 (MRP-227-A) is modified to address all conditions and limitations identified in Section 4.1 of the final SE and requires license renewal applicants to address all plant-specific action items associated with MRP-227 implementation, as identified in Section 4.2 of the SE.

LRA Amendment 15, provided by letter dated September 16, 2011, revised the PWR Reactor Vessel Internals Program in its entirety to address (to the extent possible) the staff's criteria for plant-specific PWR RVI AMPs, as required by applicant action item No. 8 and identified in Section 3.5.1 from the staff's MRP-227 SE. The staff's review of the applicant's PWR Reactor Vessel Internals Program, as revised by LRA Amendment 15, is provided in SER Section 3.0.3.3.6. The staff noted that LRA Amendment 15 included a revision to Commitment No. 15 in the USAR supplement. Originally, Commitment No. 15 stated that the PWR Reactor Vessel Internals Program will be revised, as necessary, to incorporate the final recommendations and requirements as published in MRP-227-A. Commitment No. 15, as revised by LRA Amendment 15, requires the submittal of a plant-specific inspection plan for ensuring the implementation of the NRC-approved version of the MRP-227 guidelines, including responses to all applicable plant-specific action items identified in Section 4.2 of the staff's SE for MRP-227. The implementation schedule for Commitment No. 15 specifies that these submittals shall be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff determined that Commitment No. 15, as revised by LRA Amendment 15, is acceptable for satisfying item (3) from SRP-LR Section 3.1.2.2.6, and the implementation schedule for Commitment No. 15, as amended, is consistent with item (3) from SRP-LR Section 3.1.2.2.6.

The staff also noted that all of the RVI AMR results items that refer to LRA Table 3.1.1, item 3.1.1-22 are aligned with Commitment Nos. 14 and 15, as described in LRA Appendix A, Table A-1. The staff finds the applicant's proposal acceptable because the applicant provided the appropriate commitments in the USAR supplement, and the AMR results items refer to the commitments. In its review of components associated with AMR results that refer to LRA Table 3.1.1, item 3.1.1-22, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Reactor Vessel Internals Program, as amended by LRA Amendment 15, is acceptable.

Based on the program identified above, the staff concludes that the applicant's program meets the criteria of SRP-LR Section 3.1.2.2.6. For those AMR items that apply to LRA Section 3.1.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.7 against the following criteria in SRP-LR Section 3.1.2.2.7:

(1) LRA Section 3.1.2.2.7.1, associated with LRA Table 3.1.1, item 3.1.1-23, addresses stainless steel RV flange leak detection piping and incore monitoring piping exposed to reactor coolant, which are being managed for cracking due to SCC by the PWR Water Chemistry Program and the Small Bore Class 1 Piping Inspection Program. The criteria in SRP-LR Section 3.1.2.2.7, item 1, state that cracking due to SCC could occur in the PWR stainless steel RV flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The SRP-LR also states that the GALL Report recommends further evaluation to ensure that these aging effects are adequately managed, and the GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed. The SRP-LR further states that acceptance criteria are described in BTP RLSB-1. The applicant addressed the further evaluation criteria of the SRP-LR by stating that SCC for the Davis-Besse incore piping

and flange leak detection piping is managed by the PWR Water Chemistry Program and will also be managed by the Small Bore Class 1 Piping Inspection Program.

The staff's evaluations of the applicant's PWR Water Chemistry and Small-Bore Class 1 Piping Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.1.17, respectively. In its review of components associated with item 3.1.1-23, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry Program and the Small-Bore Class 1 Piping Inspection Program is acceptable because the PWR Water Chemistry Program minimizes the concentration of contaminants that contribute to SCC, and the Small Bore Class 1 Piping Inspection Program provides either nondestructive or sample destructive examinations to confirm that SCC is not occurring in small-bore stainless steel piping. Additionally, as discussed in SER Section 3.0.3.1.17, the Small-Bore Class 1 Inspection Program accounts for operating experience with cracking of the RV flange leak detection piping because it requires draining the vessel flange leak detection lines after use thus ensuring these lines are not exposed to chlorides, which previously contributed to SCC of this piping at Davis-Besse.

(2) LRA Section 3.1.2.2.7.2, associated with LRA Table 3.1.1, item 3.1.1-24, addresses SCs in Class 1 PWR CASS piping, piping components, and piping elements exposed to reactor coolant. The applicant stated that this item is not applicable because its reactor design does not have CASS Class 1 piping, piping components, and piping elements exposed to reactor coolant. The staff reviewed LRA Sections 2.3.1 and 3.1 and the applicant's USAR and confirmed that no in-scope CASS Class 1 piping, piping components, and piping elements exposed to reactor coolant are present in the RCS and RCPB; therefore, it finds the applicant's claim acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet the criteria in SRP-LR Section 3.1.2.2.7. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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, associated with LRA Table 3.1.1, item 3.1.1-25, addresses cracking due to cyclic loading stating that this aging effect is applicable to BWR plants only.

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 confirmed that SRP-LR Section 3.1.2.2.8, item 1, is not applicable to Davis-Besse because it 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, associated with LRA Table 3.1.1, item 3.1.1-26, addresses cracking due to cyclic loading stating that this aging effect is applicable to BWR plants only.

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 confirmed that SRP-LR Section 3.1.2.2.8, item 2 is not applicable to Davis-Besse because it 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 information above, the staff concludes that the criteria in SRP-LR Section 3.1.2.2.8 do not apply.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

LRA Section 3.1.2.2.9, associated with LRA Table 3.1.1, item 3.1.1-27, addresses loss of preload due to stress relaxation. The staff reviewed LRA Section 3.1.2.2.9 against criteria in SRP-LR Section 3.1.2.2.9, which recommend no further AMR if the applicant provides a commitment in the USAR 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 commitments in the USAR supplement related to aging management of the RVI. The staff noted that Commitment No. 14 requires the implementation of the PWR Reactor Vessel Internals Program, as described in LRA Section B.2.32, upon entering the period of extended operation. LRA Section B.2.32 requires participation in industry programs for investigating and managing aging effects on the RVI, as well as evaluation and implementation of the results of industry programs as applicable to the RVI. Therefore, the staff determined that Commitment No. 14 satisfies items (1) and (2) from SRP-LR Section 3.1.2.2.9. The industry programs for investigating and managing aging effects on PWR RVI are provided in the MRP-227 report. By letter dated December 16, 2011, the staff issued Revision 1 of its final SE for MRP-227, Revision 0, wherein the staff concluded that MRP-227, Revision 0 is acceptable for referencing as the basis for PWR RVI AMPs in LRAs to the extent specified in the SE. Section 4.0 of the staff's SE for MRP-227, Revision 0 identified conditions, limitations, and license renewal applicant action items associated with MRP-227 implementation. The NRC-approved version of MRP-227 (MRP-227-A) is modified to address all conditions and limitations identified in Section 4.1 of the final SE and requires license renewal applicants to address all plant-specific action items associated with MRP-227 implementation, as identified in Section 4.2 of the SE.

LRA Amendment 15, provided by letter dated September 16, 2011, revised the PWR Reactor Vessel Internals Program in its entirety to address (to the extent possible) the staff's criteria for plant-specific PWR RVI AMPs, as required by applicant action item No. 8 and identified in Section 3.5.1 from the staff's MRP-227 SE. The staff's review of the applicant's PWR Reactor Vessel Internals Program, as revised by LRA Amendment 15, is provided in SER Section 3.0.3.3.6. The staff noted that LRA Amendment 15 included a revision to Commitment No. 15 in the USAR supplement. Originally, Commitment No. 15 stated that the PWR Reactor Vessel Internals Program will be revised, as necessary, to incorporate the final recommendations and requirements as published in MRP-227-A. Commitment No. 15, as revised by LRA Amendment 15, requires the submittal of a plant-specific inspection plan for ensuring the implementation of the NRC-approved version of the MRP-227 guidelines, including responses to all applicable plant-specific action items identified in Section 4.2 of the staff's SE for MRP-227. The implementation schedule for Commitment No. 15 specifies that these submittals shall be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff determined that Commitment No. 15, as revised by LRA Amendment 15, is acceptable for satisfying item (3) from SRP-LR Section 3.1.2.2.9, and the implementation schedule for Commitment No. 15, as amended, is consistent with item (3) from SRP-LR Section 3.1.2.2.9.

The staff also noted that all of the RVI AMR results items that refer to LRA Table 3.1.1, item 3.1.1-27 are aligned with Commitment Nos. 14 and 15, as described in LRA Appendix A, Table A-1. The staff finds the applicant's proposal acceptable because the applicant provided the appropriate commitments in the USAR supplement, and the AMR results items refer to the commitments. In its review of components associated with AMR results that refer to LRA Table 3.1.1, item 3.1.1-27, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Reactor Vessel Internals Program, as amended by LRA Amendment 15, is acceptable.

Based on the program identified above, the staff concludes that the applicant's program meets the criteria of SRP-LR Section 3.1.2.2.9. For those AMR items that apply to LRA Section 3.1.2.2.9, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.10 Loss of Material Due to Erosion

LRA Table 3.1.1, item 3.1.1-28 addresses steel SG feedwater impingement plate and support exposed to secondary feedwater. The item references SRP-LR Section 3.1.2.2.10, which states that loss of material due to erosion could occur in steel SG feedwater impingement plates and supports exposed to secondary feedwater. The applicant further stated that the plant has no feedwater impingement plates; therefore, this item is not applicable. The staff reviewed the USAR to verify the design of the applicant's SGs. Based on the information in the USAR, the staff confirmed that the applicant's SGs do not have feedwater impingement plates. Therefore, the staff finds that this item and AMR not applicable.

Based on the information above, the staff concludes that the criteria in SRP-LR Section 3.1.2.2.10 do not apply.

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 applicable to BWR plants only. SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant.

The staff finds that SRP-LR Section 3.1.2.2.11 is not applicable to Davis-Besse because it 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 information above, the staff concludes that the criteria in SRP-LR Section 3.1.2.2.11 do not apply.

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

LRA Section 3.1.2.2.12, associated with LRA Table 3.1.1, item 3.1.1-30, addresses cracking due to SCC and IASCC. The staff reviewed LRA Section 3.1.2.2.12 against criteria in SRP-LR Section 3.1.2.2.12, which recommend no further AMR if the applicant provides a commitment in the USAR supplement to do the following: (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 commitments in the USAR supplement related to aging management of the RVI. The staff noted that Commitment No. 14 requires the implementation of the PWR Reactor Vessel Internals Program, as described in LRA Section B.2.32, upon entering the period of extended operation. LRA Section B.2.32 requires participation in industry programs for investigating and managing aging effects on the RVI, as well as evaluation and implementation of the results of industry programs as applicable to the RVI. Therefore, the staff determined that Commitment No. 14 satisfies items (1) and (2) from SRP-LR Section 3.1.2.2.12. The industry programs for investigating and managing aging effects on PWR RVI are provided in the MRP-227 report. By letter dated December 16, 2011, the staff issued Revision 1 of its final SE for MRP-227, Revision 0, wherein the staff concluded that MRP-227, Revision 0 is acceptable for referencing as the basis for PWR RVI AMPs in LRAs to the extent specified in the SE. Section 4.0 of the staff's SE for MRP-227, Revision 0 identified conditions, limitations, and license renewal applicant action items associated with MRP-227 implementation. The NRC-approved version of MRP-227 (MRP-227-A) is modified to address all conditions and limitations identified in Section 4.1 of the final SE and requires license renewal applicants to address all plant-specific action items associated with MRP-227 implementation, as identified in Section 4.2 of the SE.

LRA Amendment 15, provided by letter dated September 16, 2011, revised the PWR Reactor Vessel Internals Program in its entirety to address (to the extent possible) the staff's criteria for plant-specific PWR RVI AMPs, as required by applicant action item No. 8 and identified in Section 3.5.1 from the staff's MRP-227 SE. The staff's review of the applicant's PWR Reactor Vessel Internals Program, as revised by LRA Amendment 15, is provided in SER Section 3.0.3.3.6. The staff noted that LRA Amendment 15 included a revision to Commitment No. 15 in the USAR supplement. Originally, Commitment No. 15 stated that the PWR RVI AMP will be revised, as necessary, to incorporate the final recommendations and requirements as published in MRP-227-A. Commitment No. 15, as revised by LRA Amendment 15, requires the submittal of a plant-specific inspection plan for ensuring the implementation of the NRC-approved version of the MRP-227 guidelines, including responses to all applicable plant-specific action items identified in Section 4.2 of the staff's SE for MRP-227. The implementation schedule for Commitment No. 15 specifies that these submittals shall be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff determined that Commitment No. 15, as revised by LRA Amendment 15, is acceptable for satisfying item (3) from SRP-LR Section 3.1.2.2.12, and the implementation schedule for Commitment No. 15, as amended, is consistent with item (3) from SRP-LR Section 3.1.2.2.12.

The staff also noted that all of the RVI AMR results items that refer to LRA Table 3.1.1, item 3.1.1-30 are aligned with Commitment Nos. 14 and 15, as described in LRA Appendix A, Table A-1. The staff finds the applicant's proposal acceptable because the applicant provided the appropriate commitments in the USAR supplement, and the AMR results items refer to the commitments. In its review of components associated with AMR results that refer to LRA Table 3.1.1, item 3.1.1-30, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Reactor Vessel Internals Program, as amended by LRA Amendment 15, is acceptable.

Based on the program identified above, the staff concludes that the applicant's program meets the criteria of SRP-LR Section 3.1.2.2.12. For those AMR items that apply to LRA Section 3.1.2.2.12, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking

LRA Section 3.1.2.2.13, is associated with LRA Table 3.1.1, item 3.1.1-31, and addresses components made with nickel-alloy and steel with nickel-alloy cladding exposed to primary coolant, which are being managed for PWSCC by the ISI Program, Nickel-Alloy Management Program, PWR Water Chemistry Program and Small Bore Class 1 Piping Inspection Program.

The criteria in SRP-LR Section 3.1.2.2.13 states that cracking due to PWSCC could occur in PWR components made of nickel alloy and steel with nickel-alloy cladding, including RCPB components and penetrations inside the RCS. The criteria in SRP-LR also states that use of ASME Section XI ISI (for Class 1 components) and control of water chemistry is recommended to address this mechanism. Additionally, the SRP-LR notes that no further AMR is necessary if the applicant complies with applicable NRC regulatory requirements and accepted industry guidelines. The applicant addressed the further evaluation criteria of the SRP-LR by stating that this type of cracking is managed by the ISI Program, Nickel-Alloy Management Program, PWR Water Chemistry Program, and Small Bore Class 1 Piping Inspection Program.

The staff's evaluations of the applicant's ISI Program, Nickel-Alloy Management Program, PWR Water Chemistry Program, and Small Bore Piping Inspection Program are documented in SER Sections 3.0.3.1.12, 3.0.3.3.5, 3.0.3.1.15, and 3.0.3.1.17 respectively. The staff finds, based on its review of each of these programs, that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). In its review of components associated with item 3.1.1-31 the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage aging using the ISI Program, Nickel-Alloy Management Program, PWR Water Chemistry Program, and Small Bore Class 1 Piping Inspection Program is acceptable, as each of these programs were reviewed in detail within this SE.

Based on the programs identified above, the staff concludes that the applicant's program meets SRP-LR Section 3.1.2.2.13 criteria. For those items that apply to LRA Section 3.1.2.2.13, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

LRA Table 3.1.1, item 3.1.1-32, addresses steel SG feedwater inlet rings and supports. The item references SRP-LR Section 3.1.2.2.14, which states that wall thinning due to flow-accelerated corrosion could occur in steel feedwater inlet rings and supports. The applicant stated that the plant has no feedwater inlet rings; therefore, this item is not applicable. The staff reviewed the USAR to verify the design of the applicant's SGs. Based on the information in the USAR, the staff confirmed that the applicant's SGs do not have feedwater inlet rings. Therefore, the staff finds that this item and AMR are not applicable.

Based on the information above, the staff concludes that the criteria in SRP-LR Section 3.1.2.2.14 do not apply.

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

LRA Section 3.1.2.2.15, associated with LRA Table 3.1.1, item 3.1.1-33, addresses changes in dimensions due to void swelling. The staff reviewed LRA Section 3.1.2.2.15 against criteria in SRP-LR Section 3.1.2.2.15, which recommends no further AMR if the applicant provides a commitment in the USAR supplement to do the following: (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 commitments in the USAR supplement related to aging management of the RVI. The staff noted that Commitment No. 14 requires the implementation of the PWR Reactor Vessel Internals Program, as described in LRA Section B.2.32, upon entering the period of extended operation. LRA Section B.2.32 requires participation in industry programs for investigating and managing aging effects on the RVI, as well as evaluation and implementation of the results of industry programs as applicable to the RVI. Therefore, the staff determined that Commitment No. 14 satisfies items (1) and (2) from SRP-LR Section 3.1.2.2.15. The industry programs for investigating and managing aging effects on PWR RVI are provided in the MRP-227 report. By letter dated December 16, 2011, the staff issued Revision 1 of its final SE for MRP-227, Revision 0, wherein the staff concluded that MRP-227, Revision 0 is acceptable for referencing as the basis for PWR RVI AMPs in LRAs to the extent specified in the SE. Section 4.0 of the staff's SE for MRP-227, Revision 0 identified conditions, limitations, and license renewal applicant action items associated with MRP-227 implementation. The NRC-approved version of MRP-227 (MRP-227-A) was modified to address all conditions and limitations identified in Section 4.1 of the final SE and requires license renewal applicants to address all plant-specific action items associated with MRP-227 implementation, as identified in Section 4.2 of the SE.

LRA Amendment 15, provided by letter dated September 16, 2011, revised the PWR Reactor Vessel Internals Program in its entirety to address (to the extent possible) the staff's criteria for plant-specific PWR RVI AMPs, as required by applicant action item No. 8 and identified in

Section 3.5.1 from the staff's MRP-227 SE. The staff's review of the applicant's PWR Reactor Vessel Internals Program, as revised by LRA Amendment 15, is provided in SER Section 3.0.3.3.6. The staff noted that LRA Amendment 15 included a revision to Commitment No. 15 in the USAR supplement. Originally, Commitment No. 15 stated that the PWR Reactor Vessel Internals Program will be revised, as necessary, to incorporate the final recommendations and requirements as published in MRP-227-A. Commitment No. 15, as revised by LRA Amendment 15, requires the submittal of a plant-specific inspection plan for ensuring the implementation of the NRC-approved version of the MRP-227 guidelines, including responses to all applicable plant-specific action items identified in Section 4.2 of the staff's SE for MRP-227. The implementation schedule for Commitment No. 15 specifies that these submittals shall be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff determined that Commitment No. 15, as revised by LRA Amendment 15, is acceptable for satisfying item (3) from SRP-LR Section 3.1.2.2.15, and the implementation schedule for Commitment No. 15, as amended, is consistent with item (3) from SRP-LR Section 3.1.2.2.15.

LRA Amendment 12, provided by letter dated July 22, 2011, revised LRA Section 3.1.2.2.15 and LRA Table 3.1.1, item 3.1.1-33 to state that changes in dimension due to void swelling are not identified as an aging effect requiring management for the RVI components. LRA Amendment 12 was provided in response to RAI 3.1.2.2-2 which is discussed in Section 3.1.2.1.4 of this SER. Based on LRA Amendment 12 there are no RVI AMR results that refer to LRA Table 3.1.1, item 3.1.1-33. The staff found the applicant's revision to LRA Section 3.1.2.2.15 and LRA Table 3.1.1, item 3.1.1-33 acceptable because the revision is consistent with the final disposition for B&W RVI components in MRP-227-A. Specifically, per Table 3-1 of MRP-227-A, all B&W RVI components are identified as not susceptible to significant aging effects due to void swelling. However, under the MRP-based PWR Vessel Internals Program, the program does propose inspections of RVI components on a sampling basis that is consistent with the inspection approach for sampling-based condition monitoring programs in the SRP-LR, Revision 2, Appendix A.1, Section A.1.2.3.4.4, and that establishes inspections of the RVI components based on other aging effects that the EPRI MRP has identified as having an impact on the intended functions of the components.

For those components that are inspected under the program, one of the assumptions of the EPRI MRP methodology in MRP-227-A is that the inspections are sufficient for the monitoring and detection of all aging effects, including those aging effects that were not the limiting effects for proposing the inspections of the components under the methodology. In Chapter 7 of the MRP-227-A report, the EPRI MRP also accounts for the possibility that operating xperience may develop in the future that may impact the initial assumptions of the methodology that was used to develop the MRP-227-A recommended program. In this section of the report, the EPRI MRP discusses how the review of the operating experience would be performed to determine whether the recommended program in MRP-227-A would need to be adjusted. This accounts for the possibility that the program may need to be adjusted in the future if void swelling is detected in the future as a result of the inspections that are performed in other PWRs, particularly B&W designed reactors (including the Davis-Besse plant). Such operating experience could come from inspections performed under a licensee's PWR Vessel Internals Program or from the ISI inspections that are mandated by 10 CFR 50.55a for ASME Section XI Examination Category B-N-3 core support structure components. Thus, based on this review, the staff finds the applicant's revised basis and revisions to LRA Section 3.1.2.2.15 and LRA Table 3.1.1, item 3.1.1-33 to be acceptable because: (a) the basis is consistent with the methodology and results of MRP-227-A and SRP-LR, Revision 2, Appendix A.1, and (b) the program includes an appropriate administrative controls process that would adjust the program accordingly if void swelling-related operating experience occurs in the future and demonstrates that the aging effect would need to be managed during the period of extended operation.

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.16 against the following criteria in SRP-LR Section 3.1.2.2.16:

(1) LRA Section 3.1.2.2.16.1, associated with LRA Table 3.1.1, items 3.1.1-34 and 3.1.1-35, addresses the primary coolant side of stainless steel, stainless steel clad, and nickel-alloy clad components exposed to reactor coolant, which are being managed for cracking due to SCC and PWSCC by the ISI Program, Nickel-Alloy Management Program, and PWR Water Chemistry Program.

The criteria in SRP-LR Section 3.1.2.2.16, item 1 state that cracking due to SCC could occur on the primary coolant side of PWR steel SG upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel exposed to reactor coolant. The SRP-LR also states that cracking due to PWSCC could occur for SG upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel alloy. The SRP-LR further states that the GALL Report recommends the ASME Section XI ISI Program and control of water chemistry to manage this aging. In addition, the SRP-LR states that the GALL Report recommends no further AMR of PWSCC of nickel alloys if the applicant complies with applicable NRC Orders and provides a commitment in the USAR supplement to implement applicable (1) Bulletins and GLs and (2) staff-accepted industry guidelines. The applicant addressed the further evaluation criteria of the SRP-LR by stating that cracking due to SCC (including PWSCC) on the primary coolant side of the applicant's stainless steel, stainless steel clad, and nickel-alloy clad components are managed by the ISI Program, Nickel-Alloy Management Program, and PWR Water Chemistry Program. In LRA Section B.2.28, the applicant also stated that Nickel-Alloy Management Program implements component evaluations, examination methods, scheduling and site documentation as required for compliance with 10 CFR 50, the ASME Code, NRC bulletins, NRC GLs, and staff-accepted industry guidelines related to nickel-alloy issues.

In its review, the staff noted that GALL Report, Revision 2, item IV.D2.RP-185 recommends using GALL Report AMP XI.M2, "Water Chemistry," and a plant-specific program to manage cracking due to PWSCC of SG tube-to-tube sheet welds made of nickel alloy. GALL Report, Revision 2, item IV.D2.RP-185 also recommends that a plant-specific program should be evaluated to confirm the effectiveness of the water chemistry program and to ensure that cracking is not occurring. SRP-LR, Revision 2, Section 3.1.2.2.11, item 2 states that cracking due to PWSCC could occur in SG nickel-alloy tube-to-tubesheet welds exposed to reactor coolant. The SRP-LR, Revision 2 also states that unless the NRC has approved a redefinition of the pressure boundary in which the tube-to-tubesheet weld is no longer included, the effectiveness of the primary water chemistry program should be verified to ensure that cracking is not occurring. By contrast, the staff noted that the applicant's AMR items for the SG components described in LRA Table 3.1.2-4 do not clearly address how the applicant manages the cracking due to PWSCC of SG tube-to-tubesheet welds exposed to reactor coolant.

In a teleconference call on July 13, 2011, the staff communicated with the applicant its concern regarding the omission of aging management for cracking due to PWSCC of the SG tube-to-tubesheet welds. During the teleconference call, the applicant acknowledged a need for managing this aging effect for the SG tube-to-tubesheet welds and expressed its intention to propose an aging management method that will manage the aging effect for these components. However, in its letter dated August 17, 2011, the applicant stated that upon further review after the conference call with the NRC, the applicant determined that the tube-to-tubesheet welds (Alloy 600 welds) for the applicant's SG do not have a license renewal intended function and, therefore, are not subject to an AMR. The applicant also stated that its SG are B&W Model 177-FA, once-through design, and the tubes and tubesheets of the SGs form the pressure boundary between the fluid in the secondary system and the RCS. In addition, the applicant stated that, as provided in USAR Section 5.5.2.3, the tubes are expanded (to a partial depth) into the tubesheet, and the tubes are seal welded to the tubesheet near the tube ends. Furthermore, the applicant stated that the ASME B&PV Code, Section XI, Division 1, 1995 Edition with 1996 Addenda, IWA-9000 defines a seal weld as a nonstructural weld intended to prevent leakage, where the strength is provided by a separate means. The applicant stated that the separate means in this case is the tube-to-tubesheet expansion joint which forms the pressure boundary. The applicant also stated that the tube-to-tubesheet welds are seal welds and, therefore, are not part of the pressure boundary.

In its review, the staff noted that the RCPB should provide structural and leak-tight integrity. Therefore, the applicant's statement that the tube-to-tubesheet welds are intended to prevent leakage indicates that these welds perform the intended function of the RCPB. Based on its review, the staff needed to further confirm the design analysis of the applicant's once-through SGs, which was used to establish the CLB. In particular, the staff wanted to confirm that the interference fits between the tubes, and the tubesheets are sufficient to ensure the structural and leak-tight integrity of the tube-to-tubesheet joints, without a need for crediting the tube-to-tubesheet welds.

By letter dated September 22, 2011, the staff issued RAI 3.1.2.2.16-1 requesting that the applicant confirm if the design analysis, which was used to establish the CLB, concludes that the interference fits are sufficient to ensure the structural and leak-tight integrity of the tube-to-tubesheet joints, without a need for crediting the tube-to-tubesheet welds. The staff also requested that, if the design analysis concludes that the interference fits are sufficient to ensure the structural and leak-tight integrity, the applicant provide the technical basis of the conclusion and list the reference(s) addressing the technical basis. In addition, the staff requested that, if the design analysis, which was used to establish the CLB, credits the tube-to-tubesheet welds for ensuring the structural and leak-tight integrity of the tube-to-tubesheet joints, the applicant describe how cracking due to PWSCC will be managed for the SG tube-to-tubesheet welds.

In its response dated October 21, 2011, the applicant stated that although the SG tube-to-tube sheet weld is classified as a seal weld, the applicant has confirmed that the design analyses used to establish the CLB credit both the interference fit (between the tube and tubesheet) and the tube-to-tubesheet weld for structural and leak-tight integrity. The applicant also indicated that LRA Table 3.1.2-4 is revised to include the AMR results for the tube-to-tubesheet welds, and LRA Table 2.3.1-4 is revised to list the tube-to-tubesheet weld with an intended function of pressure boundary. In addition, the applicant indicated that cracking due to PWSCC will be managed for the SG tube-to-tubesheet welds (Alloy 600) by a combination of the PWR Water Chemistry Program and the Steam Generator Tube Integrity Program. The applicant further indicated that the PWR Water Chemistry Program controls peak levels of various contaminants such as dissolved oxygen chlorides, fluorides, and sulfates below the specific limits.

In its response, the applicant also revised LRA Section A.1.38 to indicate that the Steam Generator Tube Integrity Program includes enhanced visual (EVT-1 or equivalent) examinations to monitor for cracking of the SG tube-to-tubesheet welds, and that the weld inspection sample size includes 20 percent of the subject weld population or a maximum of 25 welds, whichever is less. The applicant further indicated that in this case the maximum of 25 applies because the weld population for the two SGs is greater than 60,000. In addition, the applicant indicated that unacceptable inspection findings shall be evaluated by the Corrective Action Program using criteria in accordance with the ASME Code, Section XI. The applicant indicated that should the SGs be replaced in the future with a design such that the tube-to-tubesheet welds are fabricated of Alloy 690TT material, the examinations will no longer be required.

In its review, the staff needed to clarify whether the Alloy 690TT material, which refers to a potential material for future SG tube-to-tubesheet welds, means Alloy 690TT tubes with Alloy 690 type tubesheet cladding (e.g., Alloy 52). The staff also needed clarification as to whether Section XI of the ASME Code has acceptance criteria for these tube-to-tubesheet welds. The staff further needed to clarify whether the proposed EVT-1 inspection is capable of detecting cracking in the tube-to-tubesheet weld. In addition, the staff needed clarification on the extent to which the routine SG tube inspections, using bobbin coil or rotating coil examinations, can detect cracking of the tube-to-tubesheet welds. The staff also needed clarification on why a sample size of only 25 is adequate to monitor for the cracking of the SG tube-to-tubesheet welds in view of the following considerations:

- Potential variabilities exist in the weld chemistry, environment, and stresses in the approximately 60,000 welds.
- Alloy 600 is susceptible to PWSCC.
- The applicant's SG tubes (Alloy 600) have experienced cracking due to PWSCC, indicating that the degradation mechanism (PWSCC) exists for the SG tubes.
- The applicant's program has not implemented any inspection intended to detect cracking in the tube-to-tubesheet welds.

By letter dated November 8, 2011, the staff issued RAI 3.1.2.2.16-2 requesting that the applicant address the issues above.

In its response dated November 23, 2011, the applicant stated that the proposed design of its replacement SG includes SG tubes fabricated with Alloy 690TT material, tubesheet cladding fabricated with Alloy 690/52/152 material, and autogenous (i.e., no filler material) tube-to-tubesheet welds, which are resistant to PWSCC. The applicant also stated that, should the current SGs be replaced in the future with a design such that the tubes, tubesheet cladding, and tube-to-tubesheet welds are fabricated of Alloy 690 material, the PWR Water Chemistry Program would be sufficient to manage cracking due to PWSCC. In its review, the staff finds that the applicant's aging management method for potential replacement SG tube-to-tubesheet welds using the PWR Water

Chemistry Program is consistent with SRP-LR, Revision 2, Section 3.1.2.2.11 and provides reasonable assurance for adequate aging management because the proposed Alloy 690 type materials are resistant to PWSCC.

In its response, the applicant stated that it agrees that Section XI of the ASME Code does not have acceptance criteria for the SG tube-to-tubesheet welds. Therefore, it modified the acceptance criteria for the inspection results in its Steam Generator Tube Integrity Program to clearly state no indication of cracking or relevant conditions of degradation. The applicant also indicated that in lieu of providing information to demonstrate that the EVT-1 inspection is capable of detecting cracking in the tube-to-tubesheet welds, the inspection method for the existing SG tube-to-tubesheet welds is revised to consist of a gross visual inspection of the welds coupled with eddy-current inspections (i.e., bobbin coil or rotating coil examinations) of the tubes. The applicant further indicated that the gross visual inspection of the tube-to-tubesheet welds coupled with eddy-current inspections of the tubes will confirm the structural integrity of the tube-to-tubesheet joint.

In addition, the applicant revised the sample size for the existing SG tube-to-tubesheet welds to the following: "… at a minimum, 100 percent of the tubes are inspected at sequential periods of 60 effective full power months." The applicant also indicated that the gross visual inspections of the SG tube-to-tubesheet welds will be scheduled concurrent with the eddy-current inspections of the SG tubes that are scheduled in accordance with Davis-Besse Technical Specification 5.5.8, "Steam Generator (SG) Program." During a teleconference call, dated December 12, 2011, the applicant further clarified that the eddy-current testing is capable of detecting a crack when it propagates from a tube-to-tubesheet weld into the adjacent tube.

In its review of the RAI response, the staff noted that the applicant clarified that Section XI of the ASME Code does not have acceptance criteria for the SG tube-to-tubesheet welds and the applicant's acceptance criteria are revised to consist of no indication of cracking or relevant conditions of degradation, which are adequate to manage the aging effect. The staff also noted that the eddy-current inspections of the tube-to-tubesheet welds will be scheduled concurrent with the eddy-current inspections, which are conducted on 100 percent of the tubes at sequential periods of 60 effective full power months in accordance with the applicant's TS. However, the staff needed to further clarify whether the visual inspections to be coupled with the eddy-current inspections will be conducted on the welds on the hot leg, cold leg, or both legs. The staff also needed more clarification on the extent and method of the gross visual inspections of the tube-to-tubesheet welds.

By letter dated December 27, 2011, the staff issued RAI 3.1.2.2.16-3 requesting that the applicant clarify whether the gross visual inspections will be conducted on the welds on the hot leg, cold leg, or both legs. The staff also requested that the applicant describe the extent of the visual inspections (i.e., what percentage of the welds will be inspected) and clarify whether the gross visual inspection will be conducted on each tube-to-tubesheet weld. In addition, the staff requested that the applicant provide information on the objective, equipment, and method of the visual inspections.

In its response dated January 13, 2012, the applicant stated that the extent of the gross visual examination will be 100 percent of the SG tube-to-tubesheet welds (including both the hot leg and cold leg welds). The applicant also indicated that the visual inspections will be scheduled concurrent with the eddy-current inspections of the SG tubes that are scheduled in accordance with the applicant's TS, and 100 percent of the tube-to-tubesheet welds will be inspected at sequential periods of 60 effective full power months. The applicant further indicated that the visual inspections will consist of a remote visual examination using a manipulator camera to obtain a straight-on view of the weld with a visual acuity sufficient to detect evidence of degradation. In addition, the applicant indicated that the visual inspections will be performed by personnel qualified for ASME Code visual examination (i.e., certified VT-1 or VT-3 examiners) and is knowledgeable in the type of the tube-to-tubesheet welds being examined (i.e., fillet welds). In its response, the applicant also revised LRA Sections A.1.38 and B.2.38 and LRA Table A-1, including Commitment No. 25, consistent with its response.

In its review, the staff finds the applicant's response acceptable because (1) the visual inspections, coupled with the eddy-current inspections, will be conducted on 100 percent of the cold leg and hot leg tube-to-tubesheet welds at sequential periods of 60 effective full power months, which are sufficient in terms of the extent and schedule of inspections, (2) the applicant confirmed that the visual inspections consist of a remote visual examination using a manipulator camera with a visual acuity sufficient to detect evidence of degradation, which are adequate to detect the aging effect, and (3) personnel, who are qualified for the ASME Code visual examination and are knowledgeable in the fillet welds, will perform the visual inspections such that the qualification of the personnel can be assured. Based on the staff's review results, the staff's concerns described in RAIs 3.1.2.2.16-1, 3.1.2.2.16-2, and 3.1.2.2.16-3 are resolved.

The staff's evaluations of the applicant's ISI Program, Nickel-Alloy Management Program, and PWR Water Chemistry Program are documented in SER Sections 3.0.3.1.12, 3.0.3.3.5, and 3.0.3.1.15, respectively. In its review of components associated with items 3.1.1-34 and 3.1.1-35, except for the SG tube-to-tubesheet welds, the staff finds that the applicant has met the further evaluation criteria and the applicant's proposal to manage aging using the ISI Program, Nickel-Alloy Management Program, and PWR Water Chemistry Program is acceptable because (1) the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging, and includes the actions that will be performed to correct the conditions if the parameters exceed the limits, (2) the ISI Program uses volumetric or surface examination, which is adequate to detect and manage the aging effect consistent with the guidance in the GALL Report, (3) the Nickel-Alloy Management Program implements component evaluations, examination methods, scheduling and site documentation in compliance with 10 CFR Part 50, the ASME Code, NRC bulletins, NRC generic letters, and NRC staff-accepted industry guidelines related to nickel-alloy issues, which are also adequate to detect and manage the aging effect due to PWSCC, and (4) the use of ISI Program, Nickel-Alloy Management Program, and PWR Water Chemistry is sufficient to manage the aging effect of the primary side components made with stainless steel, stainless steel cladding, or nickel-alloy cladding.

In addition, the staff's review of the applicant's Steam Generator Tube Integrity Program is documented in SER Section 3.0.3.1.18. In its review of the SG tube-to-tubesheet welds associated with item 3.1.1-35, the staff finds that the applicant has met the further evaluation criteria and the applicant's proposal to manage aging using the PWR Water Chemistry Program and Steam Generator Tube Integrity Program is acceptable because

(1) the PWR Water Chemistry Program includes the actions that will be performed to mitigate the environmental effect on the aging if the water chemistry parameters exceed the limits, and (2) the Steam Generator Tube Integrity Program includes the visual inspections, coupled with the eddy-current inspections, of 100 percent of the tube-to-tubesheet welds at sequential periods of 60 effective full power months, which are adequate to detect and manage cracking due to PWSCC for these components.

Based on the programs identified, the staff concludes that the applicant's programs meet the criteria in SRP-LR, Revision 1, Section 3.1.2.2.16.1 and SRP-LR, Revision 2, Section 3.1.2.2.11.2. For those items that apply to LRA Section 3.1.2.2.16.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.1.2.2.16.2, is associated with LRA Table 3.1.1, item 3.1.1-36, and addresses the stainless steel pressurizer spray head exposed to primary coolant, which is being managed for PWSCC by the PWR Water Chemistry Program. The criteria in SRP-LR Section 3.1.2.2.16, item 2, state that PWSCC could occur for the stainless steel pressurizer spray head exposed to primary coolant. The SRP-LR also states that the existing program relies upon control of water chemistry to mitigate this aging effect. Additionally, the SRP-LR notes that no further AMR is necessary if the applicant complies with applicable NRC regulatory requirements and accepted industry guidelines. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the pressurizer spray head has no intended function in support of license renewal; therefore, this item is not applicable to Davis-Besse. The staff recognizes that the applicant assessed the spray nozzle and found the effects of SCC to be limited in a component that is wholly immersed in the pressurizer as a non-pressure boundary component with an intended purpose to provide flow through the component. However, the staff notes that the applicant does take actions to address potential SCC effects of this component. The staff acknowledges that the applicant will implement the PWR Water Chemistry Program to verify effectiveness of the PWR water chemistry to address SCC in stainless steel components.

The staff's evaluation of the applicant's PWR Water Chemistry Program is documented in SER Section 3.0.3.1.15. The staff notes in the review of this program that the effects of aging will be adequately managed so that the intended function will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). In its review of components associated with item 3.1.1-36, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry Program and comply with applicable NRC regulatory requirements and accepted industry guidelines is acceptable, as this AMR program was reviewed in detail within this SE. No further discussion under this section is deemed necessary.

Based on the program identified, the staff concludes that the applicant's program is adequate to meet SRP-LR Section 3.1.2.2.16.2 criteria. For those items that apply to LRA Section 3.1.2.2.16.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.16 criteria. For those AMR items that apply to LRA Section 3.1.2.2.16 the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

LRA Section 3.1.2.2.17, associated with LRA Table 3.1.1, item 3.1.1-37, addresses 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, which recommends no further AMR if the applicant provides a commitment in the USAR supplement to do the following: (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 commitments in the USAR supplement related to aging management of the RVI. The staff noted that Commitment No. 14 requires the implementation of the PWR Reactor Vessel Internals Program, as described in LRA Section B.2.32, upon entering the period of extended operation. LRA Section B.2.32 requires participation in industry programs for investigating and managing aging effects on the RVI, as well as evaluation and implementation of the results of industry programs as applicable to the RVI. Therefore, the staff determined that Commitment No. 14 satisfies items (1) and (2) from SRP-LR Section 3.1.2.2.17. The industry programs for investigating and managing aging effects on PWR RVI are provided in the MRP-227 report. By letter dated December 16, 2011, the staff issued Revision 1 of its final SE for MRP-227, Revision 0, wherein the staff concluded that MRP-227, Revision 0 is acceptable for referencing as the basis for PWR RVI AMPs in LRAs to the extent specified in the SE. Section 4.0 of the staff's SE for MRP-227, Revision 0 identified conditions, limitations, and license renewal applicant action items associated with MRP-227 implementation. The NRC-approved version of MRP-227 (MRP-227-A) is modified to address all conditions and limitations identified in Section 4.1 of the final SE and requires license renewal applicants to address all plant-specific action items associated with MRP-227 implementation, as identified in Section 4.2 of the SE.

LRA Amendment 15, provided by letter dated September 16, 2011, revised the PWR Reactor Vessel Internals Program in its entirety to address (to the extent possible) the staff's criteria for plant-specific PWR Reactor Vessel Internals Program, as required by applicant action item No. 8 and identified in Section 3.5.1 from the staff's MRP-227 SE. The staff's review of the applicant's PWR Reactor Vessel Internals Program, as revised by LRA Amendment 15, is provided in SER Section 3.0.3.3.6. The staff noted that LRA Amendment 15 included a revision to Commitment No. 15 in the USAR supplement. Originally, Commitment No. 15 stated that the PWR Reactor Vessel Internals Program will be revised, as necessary, to incorporate the final recommendations and requirements as published in MRP-227-A. Commitment No. 15, as revised by LRA Amendment 15, requires the submittal of a plant-specific inspection plan for ensuring the implementation of the NRC-approved version of the MRP-227 guidelines, including responses to all applicable plant-specific action items identified in Section 4.2 of the staff's SE for MRP-227. The implementation schedule for Commitment No. 15 specifies that these submittals shall be made no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation, whichever is earlier. The staff determined that Commitment No. 15, as revised by LRA Amendment 15, is acceptable for satisfying item (3) from SRP-LR Section 3.1.2.2.17, and the implementation schedule for Commitment No. 15, as amended, is consistent with item (3) from SRP-LR Section 3.1.2.2.17.

The staff also noted that all of the RVI AMR results items that refer to LRA Table 3.1.1, item 3.1.1-37 are aligned with Commitment Nos. 14 and 15, as described in LRA Appendix A, Table A-1. The staff finds the applicant's proposal acceptable because the applicant provided the appropriate commitments in the USAR supplement, and the AMR results items refer to the commitments. In its review of components associated with AMR results that refer to LRA Table 3.1.1, item 3.1.1-37, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Reactor Vessel Internals Program, as amended by LRA Amendment 15, is acceptable.

Based on program identified above, the staff concludes that the applicant's program meets the criteria of SRP-LR Section 3.1.2.2.17. For those AMR items that apply to LRA Section 3.1.2.2.17, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.1.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.1.2-1 through 3.1.2-4, 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–J, that the combination of component type, material, environment, and AERM does not correspond to a AMR 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 item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the AMR item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the AMR 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 if the applicant demonstrated that the aging effects will be adequately managed so that the intended function(s) will remain 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 Pressure Vessel—Aging Management Review Results—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 pressure vessel component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the reactor pressure vessel component groups are consistent with the GALL Report.

3.1.2.3.2 Reactor Coolant System—Reactor Vessel Internals—Aging Management Review Results—LRA Table 3.1.2-2

LRA Table 3.1.2-2 as supplemented by letter dated September 6, 2011, states that the stainless steel baffle-to-former bolts, baffle-to-baffle bolts, and core barrel-to-former bolts exposed to borated reactor coolant with neutron fluence are being managed for cracking due to fatigue by the PWR Reactor Vessel Internals Program and PWR Water Chemistry Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, Revision 2, items IV.B4.RP-241 and IV.B4.RP-244, which address baffle-to-former bolts, baffle-to-baffle bolts, and core barrel-to-former bolts exposed to reactor coolant and neutron flux. GALL Report, Revision 2 recommends the Water Chemistry Program and the PWR Vessel Internals Program to manage cracking due to SCC and IASCC; however, the applicant identified cracking due to fatigue as an additional aging effect. In its review, the staff noted that the applicant addressed the GALL Report–identified aging effect for this component, material, and environment combination in the AMR items in LRA Table 3.1.2-2. The staff also noted that GALL Report, Revision 2, AMP XI.M16A, "PWR Vessel Internals," includes the inspection and evaluation guidance addressed in MRP-227, Revision 0. The staff further noted that Tables 3-1, 4-1, and 4-4 of MRP-227, Revision 0, identify that cracking due to fatigue is an applicable aging effect to the baffle-to-former bolts, baffle-to-baffle bolts, and core barrel-to-former bolts exposed to reactor coolant. Therefore, the staff finds that the applicant's AMR items, which address cracking due to fatigue of these components, are consistent with GALL Report, Revision 2, AMP XI.M16A and MRP-227, Revision 0. In addition, the staff noted that GALL Report, Revision 2, item IV.B4.RP-375 addresses cracking due to fatigue of internal baffle-to-former bolts and recommends the use of the Water Chemistry Program and the PWR Vessel Internals Program to manage this aging effect. The staff finds that the applicant's AMR items are consistent with the aging management method described in GALL Report, Revision 2, item IV.B4.RP-375.

The staff's evaluations of the applicant's PWR Reactor Vessel Internals Program and PWR Water Chemistry Program are documented in SER Sections 3.0.3.3.6 and 3.0.3.1.15, respectively. The staff finds the applicant's proposal to manage aging using the PWR Reactor Vessel Internals and PWR Water Chemistry Program acceptable because (1) the PWR Reactor Vessel Internals Program includes volumetric inspections, evaluations, and replacement activities for these components, consistent with the GALL Report, which ensure timely detection and management of cracking due to fatigue, and (2) the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and includes the actions that will be performed if the parameters exceed the limits.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Reactor Coolant System—Reactor Coolant System and Reactor Coolant Pressure Boundary—Aging Management Review Results—LRA Table 3.1.2-3

In LRA Table 3.1.2-3, the applicant stated that the stainless steel bolting exposed to air with steam or water leakage (external) are being managed for loss of material by the Bolting Integrity Program. The AMR items cite generic note H.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Report Table IX.C states that stainless steels are susceptible to loss of material due to pitting and crevice corrosion and cracking due to SCC. GALL Report AMP XI.M18, “Bolting Integrity,” also indicates that a loss of preload is an aging effect that is monitored for bolting materials. The cracking and loss of preload aging effects are addressed in other items. Thus, the aging effect of concern is loss of material, which is addressed in the AMR.

The staff’s evaluation of the applicant’s Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant’s proposal to manage aging using the Bolting Integrity Program acceptable because it will use periodic visual inspections that would detect loss of material prior to loss of component intended function.

In LRA Table 3.1.2-3, the applicant stated that nickel-alloy RCP seal cooling heat exchanger tubes (inner) exposed to borated reactor coolant (internal) are being managed for reduction in heat transfer by the PWR Water Chemistry Program. The AMR item cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, which addresses nickel-alloy components exposed to reactor coolant and recommends aging management for cracking and loss of material; however, the applicant identified the additional aging effect of reduction in heat transfer. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in AMR items in LRA Table 3.1.2-3.

The staff’s evaluation of the applicant’s PWR Water Chemistry Program is documented in SER Section 3.0.3.1.15. The staff noted that the applicant’s program mitigates fouling by managing the relevant conditions that could lead to reduction in heat transfer through proper monitoring and control of water chemistry consistent with EPRI guidelines. In addition, the staff determined that the applicant is monitoring relevant conditions that are known detrimental contaminants such as sulfates, halogens (chlorides and fluorides), dissolved oxygen, and conductivity that can cause reduction in heat transfer. The staff finds the applicant’s proposal to manage aging using the PWR Chemistry Program acceptable because the applicant monitors and controls contaminants that are known to cause reduction in heat transfer, which creates an environment that is not conducive for this aging effect to occur.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.4 Reactor Coolant System—Steam Generators—Aging Management Review Results—LRA Table 3.1.2-4

In LRA Table 3.1.2-4, the applicant stated that nickel-alloy primary side tubes and sleeves exposed to treated water (external), on the secondary side, are being managed for reduction in heat transfer by the PWR Water Chemistry Program and the Steam Generator Tube Integrity Program. The AMR item cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, which addresses nickel-alloy components exposed to reactor coolant and secondary feedwater and recommends GALL Report AMP XI.M2 and XI.M19 to manage cracking and loss of material; however, the applicant identified the additional aging effect of reduction in heat transfer. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in AMR items in LRA Table 3.1.2-4.

The staff's evaluations of the applicant's PWR Water Chemistry Program and Steam Generator Tube Integrity Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.1.18, respectively. The staff noted that the applicant's PWR Water Chemistry Program mitigates damage due to reduction in heat transfer by managing the relevant conditions that could lead to the onset and propagation of reduction in heat transfer through proper monitoring and control consistent with EPRI guidelines. In addition, the staff determined that the applicant is monitoring relevant conditions that are known detrimental contaminants such as sulfates, halogens (chlorides and fluorides), dissolved oxygen, and conductivity that can cause reduction in heat transfer. The staff noted that the applicant's Steam Generator Tube Integrity Program performs inspections in accordance with its TS requirements, which include visual inspections of the secondary side components. In addition, these visual inspections are capable of detecting the accumulation of deposits on the surface of the tubes and sleeves that can cause reduction in heat transfer. The staff finds the applicant's proposal to manage aging using the PWR Chemistry Program and Steam Generator Tube Integrity Program acceptable because the applicant monitors and controls contaminants known to cause reduction in heat transfer, which creates an environment that is not conducive for this aging effect to occur, and the applicant performs periodic visual inspections to confirm the effectiveness of its water chemistry on the secondary side components.

In LRA Table 3.1.2-4, the applicant stated that nickel-alloy SG tubes and sleeves exposed to borated reactor coolant (internal) are susceptible to a reduction in heat transfer and are managed by the Steam Generator Tube Integrity and PWR Water Chemistry Programs. The AMR item cites generic note H. However, during a public meeting on February 18, 2011, industry Steam Generator Task Force representatives indicated that primary side fouling of SG tubes is not an issue in the U.S. Given the Task Force finding, the staff initiated a teleconference call dated July 12, 2011, to get clarification on the aging mechanism for the applicant's SG tubes in a borated reactor coolant environment. In its response to the teleconference dated August, 17, 2011, the applicant stated reduction in heat transfer of the primary side of the nickel-alloy tubing and sleeves for the Davis-Besse SG has not been experienced. The applicant also stated that it is not aware of any industry operating experience that would suggest that primary side loss of heat transfer of the SG tubes in a borated reactor coolant environment has become an issue. Therefore, the applicant removed rows 30 and 31 from the application, as they were deemed not applicable.

Based on the outcome of the SG Task Force public meeting held on February 18, 2011, the staff confirmed that the applicant's nickel-alloy SG tubes and sleeves exposed to borated reactor coolant (internal) are not susceptible to reduction of heat transfer. Therefore, the staff finds rows 30 and 31 of LRA Table 3.1.2-4 to be not applicable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concludes that the applicant provided sufficient information to demonstrate that the effects of aging for the RPV, RVIs, RCS and RCPB, and SG components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 Aging Management of Engineered Safety Features

This section of the SER documents the staff's review of the applicant's AMR results for the ESFs components and component groups of the following systems:

- containment air cooling and recirculation system
- containment spray system
- core flooding system
- DHR and LPI system
- HPI 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 Programs for Engineered Safety Features Systems Evaluated in Chapter V of NUREG-1801," 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 if 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 remain 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 identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Sections 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 that the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR items and the plant's operating experience to verify the applicant's claims.

Table 3.2-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.2 and addressed in the GALL Report.

Table 3.2-1. Staff evaluation for engineered safety features systems components in the GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel and stainless steel piping, piping components, and piping elements in ECCS (3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.2.2.2.1)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.2.1-2)	Loss of material due to cladding breach	A plant-specific AMP is to be evaluated. Reference NRC IN 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks"	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.2.2)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.2.2.2.3(1))
Stainless steel piping, piping components, and piping elements exposed to soil (3.2.1-4)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.2.3(2))
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.2.1-5)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.3(3))
Stainless steel and copper-alloy piping, piping components, and piping elements exposed to lubricating oil (3.2.1-6)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.2.2.2.3(4))
Partially encased stainless steel tanks with breached moisture barrier exposed to raw water (3.2.1-7)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.2.3(5))
Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) (3.2.1-8)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.2.2.2.3(6))

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel, stainless steel, and copper-alloy HX 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 and One-Time Inspection	Consistent with GALL Report (see SER Section 3.2.2.2.4(1))
Stainless steel HX tubes exposed to treated water (3.2.1-10)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.2.2.2.4(2))
Elastomer seals and components in standby gas treatment system exposed to air-indoor uncontrolled (3.2.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.5)
Stainless steel high-pressure safety injection (HPSI) (charging) pump miniflow orifice exposed to treated borated water (3.2.1-12)	Loss of material due to erosion	A plant-specific AMP is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging.	Yes	Not applicable	Not applicable to Davis-Besse (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 AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.7)
Steel piping, piping components, and piping elements exposed to treated water (3.2.1-14)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.8(1))

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, 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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.2.8(2))
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.2.2.2.8(3))
Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil (3.2.1-17)	Loss of material due to general, pitting, crevice, and MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.2.9)
Stainless steel piping, piping components, and piping elements exposed to treated water > 140 °F (> 60 °C) (3.2.1-18)	Cracking due to SCC and IGSCC	BWR SCC and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs (See SER Section 3.2.2.1.1)
CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) > 482 °F (> 250 °C) (3.2.1-20)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to PWRs (See SER Section 3.2.2.1.1)

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-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading, SCC	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
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	Bolting Integrity	Consistent with GALL Report
Steel bolting and closure bolting exposed to air-outdoor (external), or air-indoor uncontrolled (external) (3.2.1-23)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel closure bolting exposed to air-indoor uncontrolled (external) (3.2.1-24)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water > 140 °F (> 60 °C) (3.2.1-25)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (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 Davis-Besse (see SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to closed-cycle cooling water (3.2.1-27)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.2.2.1.2)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel piping, piping components, piping elements, and HX 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 Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.2.2.1.3)
Copper-alloy piping, piping components, piping elements, and HX 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	Closed Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.2.2.1.4)
Stainless steel and copper-alloy HX tubes exposed to closed-cycle cooling water (3.2.1-30)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.2.2.1.5)
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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel 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 Davis-Besse (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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)
Steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-35)	Loss of material due to general, pitting, crevice, and MIC and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)
Steel HX components exposed to raw water (3.2.1-36)	Loss of material due to general, pitting, crevice, galvanic, and MIC and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (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 MIC	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (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 MIC and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)
Stainless steel HX components exposed to raw water (3.2.1-39)	Loss of material due to pitting, crevice, and MIC and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel and stainless steel HX 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 Davis-Besse (see SER Section 3.2.2.1.1)
Copper-alloy > 15% Zn piping, piping components, piping elements, and HX components exposed to closed cycle cooling water (3.2.1-41)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1))
Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water (3.2.1-42)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection	Consistent with GALL Report
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 Davis-Besse (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 Davis-Besse (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

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 encapsulation components exposed to air with borated water leakage (internal) (3.2.1-46)	Loss of material due to general, pitting, crevice, and boric acid corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)
CASS piping, piping components, and piping elements exposed to treated borated water > 482 °F (> 250 °C) (3.2.1-47)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to Davis-Besse (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 > 140 °F (> 60 °C) (3.2.1-48)	Cracking due to SCC	Water Chemistry	No	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.2.2.1.6)
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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Sections 3.2.2.1.7)
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	Not applicable	Not applicable to Davis-Besse 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
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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)
Stainless steel, copper-alloy, and nickel-alloy piping, piping components, and piping elements exposed to air-indoor uncontrolled (external) (3.2.1-53)	None	None	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	Not applicable	Not applicable to Davis-Besse (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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.2.2.1.1)
Steel, stainless steel, and copper-alloy piping, piping components, and piping elements exposed to gas (3.2.1-56)	None	None	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 that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.2.2.2, discusses the staff's review of AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.2.2.3, discusses the staff's review of AMR results for components that the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the ESF components is documented in SER Section 3.0.3.

As a result of Revision 2 to the SRP-LR and the GALL Report, there was a significant realignment of AMR items as follows:

- In some cases, changes were of an administrative nature (e.g., an identical material, environment, aging effect, and recommended program in Table 3.2-1of the SRP-LR was renumbered with no other changes).
- Technical changes were implemented for specific Table 3.2-1 items (e.g., component information clarified, changes to environment, added concrete attributes evaluation, clarified BWR and PWR applicability).
- Many SRP-LR further evaluation recommendations were eliminated, principally because Revision 2 implemented changes to GALL Report AMPs and AMR items resulting in the further evaluation being addressed. As an example, Revision 1 of the SRP-LR and GALL Report recommended a further evaluation of a plant-specific program to manage hardening and loss of strength of elastomeric components exposed to air-indoor uncontrolled. Revision 2 of the SRP-LR and GALL Report incorporated elastomeric components, including visual exams and manipulation of the material into GALL Report AMPs XI.M36, "External Surfaces Monitoring of Mechanical Components" and XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," thus eliminating the need for a plant-specific program.
- Revision 2 contains additional material, environment, and aging effect combinations, thus eliminating the need for citing generic notes F–J given that the applicant could now select a Table 3.2-1 that is consistent. For example, AMR item 3.4-53, which addresses copper-alloy (less than or equal to 15 percent Zn and less than or equal to 8 percent Al) piping, piping components, and piping elements exposed to air with borated water leakage, was added.

In each instance, regardless of the type of change, the staff evaluated the Revision 1 technical requirements compared to the Revision 2 technical requirements and ensured that the applicant's LRA was evaluated against the current staff position as contained in Revision 2.

3.2.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.2.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the ESF components:

- Bolting Integrity Program
- Boric Acid Corrosion Program
- Closed Cooling Water Chemistry Program

- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water Program
- PWR Water Chemistry Program
- Selective Leaching Inspection

LRA Tables 3.2.2-1 through 3.2.2-5 summarize AMRs for the ESFs components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined if the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

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

Note A indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

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

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

Note D indicates that the component for the AMR item, although different from, 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 AMR items to verify consistency with the GALL Report. The staff confirmed whether the AMR item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

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

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.

On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable, and no further staff review is required.

3.2.2.1.1 AMR Results Identified as Not Applicable

For items 3.2.1-18 through 3.2.1-20 in LRA Table 3.2.1, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR, confirmed these items only apply to BWRs, and finds these items are not applicable to Davis-Besse.

For items 3.2.1-25, 3.2.1-26, 3.2.1-33 through 3.2.1-40, 3.2.1-43, 3.2.1-44, 3.2.1-46, 3.2.1-47, 3.2.1-52, 3.2.1-54, and 3.2.1-55 in LRA Table 3.2.1, the applicant claimed that they were not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Davis-Besse. The staff reviewed the LRA and USAR and confirmed that the applicant's LRA does not have any AMR results that are applicable to these items.

For LRA Table 3.2.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable; however, the staff non-applicability verification of these items required the review of sources beyond the LRA and FSAR, and/or the issuance of RAIs.

LRA Table 3.2.1, item 3.2.1-32, addresses the internal surfaces of steel piping and ducting components exposed to air-indoor uncontrolled. The GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to manage loss of material due to general corrosion for this component group. The applicant stated that this item is not applicable because the component group is managed by the External Surfaces Monitoring Program where it has been demonstrated that the internal environment is the same as the external environment. The items credit LRA Table 3.2.1, item 3.2.1-31, which is for the external surfaces of components with the same material and environment combination. The staff evaluated the applicant's claim and found it acceptable because the external surfaces of components are representative of the internal surfaces of components for which the environments are the same; therefore, the internal surfaces are equivalently managed by the External Surfaces Monitoring Program.

LRA Table 3.2.1, item 3.2.1-41, addresses copper-alloy (greater than 15 percent Zn) piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends the Selective Leaching of Materials Program to manage loss of material due to selective leaching for this component group. The applicant stated that this item is not applicable because the copper-alloy (greater than 15 percent Zn) heat exchanger tubes are made of admiralty brass, which is an inhibited copper alloy and is not susceptible to selective leaching, and the ESF systems do not contain any other copper-alloy (greater than 15 percent Zn) piping, piping components, or piping elements exposed to closed cycle cooling water. The staff noted that admiralty brass is considered an inhibited brass due to the presence of inhibiting elements of arsenic, antimony or phosphorus (Fontana, M.G., “Corrosion Engineering,” 3rd Edition). The staff evaluated the applicant’s claim and found it acceptable because GALL Report AMP XI.M33, “Selective Leaching of Materials,” states that selective leaching may occur to copper alloys greater than 15 percent Zn, except for inhibited brass, and the staff reviewed LRA Sections 2.3.2 and 3.2 and the applicant’s USAR and confirmed that no in-scope copper-alloy (greater than 15 percent Zn) piping, piping components, or piping elements exposed to closed cycle cooling water are present in the ESF systems.

LRA Table 3.2.1, item 3.2.1-51, addresses galvanized steel ducting exposed to controlled indoor air (external) and states that there are no aging effects, aging mechanisms, or AMPs. The GALL Report, Table V, item V.F-1 (EP-14), recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group exposed to this environment. The applicant stated that this item is not applicable because no credit is taken for coatings; therefore, the material is evaluated as steel. The applicant also stated that all indoor air environments were evaluated as uncontrolled environments. The staff noted that in place of item 3.2.1-51, the applicant applied LRA Table 3.3.1, item 3.3.1-56, which addresses the external surfaces of steel ducting and components exposed to uncontrolled indoor air, which are managed for loss of material due to general corrosion by the External Surfaces Monitoring Program. The staff evaluated the applicant’s claim and found it acceptable because the applicant’s decision to not credit coatings for the prevention of aging and to consider indoor air environments as uncontrolled is a reasonable approach to ensure that loss of material due to general corrosion will be adequately managed during the period of extended operation.

3.2.2.1.2 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.2.1, item 3.2.1-27, addresses steel heat exchanger components exposed to closed-cycle cooling water, which are being managed for loss of material due to general, pitting, crevice, and galvanic corrosion. The staff noted that the applicant also applies this item to gray cast iron heat exchanger components. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, “Closed-Cycle Cooling Water System,” to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, the GALL Report AMP XI.M21 recommends performance monitoring techniques for heat exchangers to manage the aging of this item. In its review of components associated with item 3.2.1-27, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of steel and gray cast iron heat exchanger components through chemistry controls consistent with current water chemistry guidelines, periodic inspections, on a 10-year interval, and corrosion rate measurements via corrosion coupons to ensure that material degradation is not occurring.

The staff’s evaluation of the applicant’s Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.2.1-27, the staff finds the applicant’s proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.3 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.2.1, item 3.2.1-28, addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water, which are being managed for loss of material due to pitting and crevice corrosion. The staff noted that the applicant also applies this item to nickel-alloy heat exchanger components exposed to closed-cycle cooling water. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For the stainless steel heat exchanger components, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for heat exchangers to manage the aging of this item. In its review of components associated with item 3.2.1-28, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of stainless steel and nickel-alloy heat exchanger components through chemistry controls consistent with current EPRI water chemistry guidelines, periodic inspections on a 10-year interval, and corrosion rate measurements via corrosion coupons to ensure that material degradation is not occurring.

The applicant stated that, for item 3.2.1-28, the applicability is limited to stainless steel and nickel-alloy heat exchanger components exposed to closed-cycle cooling water. The staff noted that a search of the applicant's USAR confirmed that no in-scope stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water are present in the ESF systems.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.2.1-28, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.4 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.2.1, item 3.2.1-29, addresses copper-alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water, which are being managed for loss of material due to pitting, crevice, and galvanic corrosion. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL

Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.2.1-29, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of copper-alloy heat exchanger components through chemistry controls consistent with current EPRI water chemistry guidelines, periodic inspections on a 10-year interval, and corrosion rate measurements via corrosion coupons to ensure that material degradation is not occurring.

The applicant stated that, for item 3.2.1-29, the applicability is limited to copper-alloy heat exchanger components exposed to closed-cycle cooling water. The staff noted that a search of the applicant's USAR confirmed that no in-scope copper-alloy piping, piping components, and piping elements exposed to closed-cycle cooling water are present in the ESF systems.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.2.1-29, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.5 Reduction of Heat Transfer Due to Fouling

LRA Table 3.2.1, item 3.2.1-30, addresses stainless steel and copper-alloy heat exchanger tubes exposed to closed-cycle cooling water, which are being managed for reduction of heat transfer due to fouling. The staff noted that the applicant also applied this item to nickel-alloy heat exchanger tubes exposed to closed-cycle cooling water. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For the stainless steel and copper components, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.2.1-30, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of stainless steel, copper-alloy, and nickel-alloy heat exchanger tubes through chemistry controls consistent with current EPRI water chemistry guidelines and periodic inspections, on a 10-year interval, to ensure that fouling is not occurring.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.2.1-30, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on reduction of heat transfer due to fouling, and the periodic inspections can detect the presence or extent of fouling prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.6 Cracking Due to Stress Corrosion Cracking

LRA Table 3.2.1, item 3.2.1-48, addresses stainless steel or stainless steel clad steel piping, piping components, piping elements, and tanks exposed to treated borated water greater than 140 °F (60 °(C)), which are being managed for cracking due to SCC. The LRA credits the PWR Water Chemistry Program to manage the aging effect. In addition, the applicant credits the One-Time Inspection Program to confirm the effectiveness of the PWR Water Chemistry Program for adequate aging management of cracking. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," to ensure that the aging effect is adequately managed. The associated AMR items cite generic note E.

For those items associated with generic note E, GALL Report AMP XI.M2 recommends using water chemistry control to manage the aging of these AMR items. In its review of the components associated with item 3.2.1-48, for which the applicant cited generic note E, the staff noted that the PWR Water Chemistry Program manages the aging of stainless steel or stainless steel clad steel piping, piping components, piping elements, and tanks through the use of water chemistry control, and the One-Time Inspection Program will use a one-time inspection to confirm the effectiveness of the PWR Water Chemistry Program for adequate aging management of cracking due to SCC.

The staff's evaluations of the applicant's PWR Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-48, the staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program and One-Time Inspection Program acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and includes the actions that will be performed if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes a one-time inspection of select components to confirm the effectiveness of the PWR Water Chemistry Program to ensure that it will adequately manage the aging effect due to SCC of the components.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.7 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.2.1, item 3.2.1-49, addresses stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water, which are being managed for loss of material due to pitting and crevice corrosion. The staff noted that the applicant also applies this item to stainless steel heat exchanger components and separators. The LRA credits the PWR Water Chemistry and One-Time Inspection Programs to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," to ensure that these aging effects are adequately managed. The AMR items associated with the One-Time Inspection Program cite generic note E.

For these items, GALL Report AMP XI.M2 recommends using water chemistry controls to manage the aging. In its review of components associated with item 3.2.1-49, the staff noted that the PWR Water Chemistry and One-Time Inspection Programs propose to manage the aging of stainless steel piping, piping components, piping elements, tanks, heat exchanger components, and separators through the use of water chemistry controls and a one-time visual inspection to verify the effectiveness of the PWR Water Chemistry Program.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-49, the staff finds the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and identifies the actions required if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the ESF components and provides 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 MIC
- 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 further evaluation is recommended, the staff audited and reviewed the applicant's evaluations to determine if 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, associated with LRA Table 3.2.1, item 3.2.1-1, addresses steel and stainless steel piping, piping components, and piping elements in the ECCSs that are being managed for cumulative fatigue damage. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, and is required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed separately in LRA Section 4.3.

The staff reviewed LRA Section 3.2.2.2.1 against the criteria in SRP-LR Section 3.2.2.2.1, which state that cumulative fatigue damage of steel and stainless steel piping, piping components, and piping elements in the ECCSs is a TLAA, and these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c) and in accordance with SRP-LR Section 4.3, “Metal Fatigue Analysis.” The staff reviewed the applicant’s AMR items and finds that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage in steel and stainless steel piping, piping components, and piping elements, except as identified below.

The staff reviewed AMR results in the associated LRA Tables (3.x.2-y) in LRA Sections 3.2, 3.3, and 3.4 and noted that they did not include the applicable AMR items for the TLAAs associated with fatigue of non-Class 1 piping and in-line components. LRA Section 4.3.3.1 discusses the TLAAs associated with fatigue of non-Class 1 piping and in-line components and states that these TLAAs will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). It is not clear to the staff why the components analyzed for cumulative fatigue damage by the TLAAs discussed in LRA Section 4.3.3.1 are not included as AMR items in LRA Sections 3.2, 3.3, and 3.4.

By letter dated May 2, 2011, the staff issued RAI 3.2.2.2.1-1 requesting the applicant to justify that LRA Tables 3.2.2-y, 3.3.2-y, and 3.4.2-y do not need to identify and list all the AMR results for non-Class 1 piping and in-line components associated with a TLAA for managing the aging effect of cumulative fatigue damage.

In its response dated June 3, 2011, the applicant amended the LRA to include additional AMR items in the applicable LRA tables to identify ASME Code non-Class 1 piping and in-line components that are subject to an AMR that credit a TLAA to manage cumulative fatigue damage. The applicant further stated that, for the ESF systems, LRA Tables 3.2.2-1 and 3.2.2-4 required the following:

- LRA Table 3.2.2-1 was amended to include the associated AMR item for steel piping exposed to air-indoor uncontrolled, consistent with the GALL Report AMR, item VII.E1-18.
- LRA Table 3.2.2-4 was amended to include the associated AMR items for stainless steel orifices, piping, tubing, and valve bodies and CASS separators exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item V.D1-27.

The applicant further stated that, for auxiliary systems, LRA Tables 3.3.2-3, 3.3.2-8, 3.3.2-9, 3.3.2-10, 3.3.2-12, 3.3.2-14, 3.3.2-18, 3.3.2-24, 3.3.2-25, and 3.3.2-30 required the addition of AMR items. LRA Table 3.3.2-3 was amended to include the associated AMR items for stainless steel orifices and valve bodies exposed to treated borated water greater than 60 °C, consistent with GALL Report AMR, item VII.E3-14. LRA Table 3.3.2-3 was also amended to include the associated AMR items for steel piping, tubing, and valve bodies exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item VIII.B1-10. The applicant amended LRA Tables 3.3.2-8, 3.3.2-9, 3.3.2-10 to include the associated AMR item for steel piping exposed to air-indoor uncontrolled, consistent with the GALL Report AMR, item VII.E1-18. Furthermore, the applicant also amended LRA Tables 3.3.2-18, 3.3.2-24, and 3.3.2-25 to include the associated AMR item for stainless steel piping exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item VII.E1-16.

The applicant further stated that, for steam and power conversion systems, LRA Tables 3.4.2-1, 3.4.2-3, and 3.4.2-4 required the addition of AMR items. The applicant amended LRA Table 3.4.2-1 to include the associated AMR item for steel piping exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item VIII.G-37. The applicant also amended LRA Tables 3.4.2-3 and 3.4.2-4 to include the associated AMR items for stainless steel orifices, tubing, and valve bodies exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item VII.E3-14. Furthermore, the applicant amended LRA Table 3.4.2-3 to include the associated AMR items steel piping and valve bodies exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item VIII.D1-7. The applicant also amended LRA Table 3.4.2-4 to include the associated AMR items for steel piping and valve bodies exposed to treated borated water greater than 60 °C, consistent with the GALL Report AMR, item VIII.B1-10. The staff confirmed that these additional AMR items identified above are consistent with the associated GALL Report AMR items and, therefore, are acceptable. The staff's evaluation of the fatigue TLAA for non-Class 1 piping and in-line components is documented in SER Section 4.3.3.1.2.

The applicant also identified additional AMR items in LRA Tables 3.3.2-12, 3.3.2-14, 3.3.2-16, and 3.3.2-30. The staff's reviews of these additional AMR items are documented in SER Sections 3.3.2.3.12, 3.3.2.3.14, 3.3.2.3.16, and 3.3.2.3.30, respectively. The additional AMR items cite generic note H and a plant-specific note indicating that the fatigue TLAA is evaluated in LRA Section 4.3.3.1 for piping and in-line piping components.

Based on its review of the amended LRA Tables in Sections 3.2, 3.3, and 3.4, the staff finds the applicant's response to RAI 3.2.2.2.1-1, and the additions of these AMR lines items, acceptable because the components subject to an AMR that credit a TLAA in the LRA to manage cumulative fatigue damage were identified, and these AMR items are consistent with the recommendations of the referenced GALL Report AMR items. For component, material, and environment combinations that are not evaluated in the GALL Report, the staff finds the applicant's response acceptable because the components subject to an AMR that credit a TLAA were identified, and the applicant identified the applicable TLAA in the LRA that is credited to manage cumulative fatigue damage. The staff's concern described in RAI 3.2.2.2.1-1 is resolved.

Based on the staff's review, it concludes that the applicant has met the SRP-LR Section 3.2.2.2.1 criteria. For those items that apply to LRA Section 3.2.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3 documents the staff's review of the applicant's evaluation of the TLAA for these components.

3.2.2.2.2 Loss of Material Due to Cladding Breach

LRA Section 3.2.2.2.2, associated with LRA Table 3.2.1, item 3.2.1-2, addresses steel with stainless steel cladding pump casings exposed to treated borated water, which are being managed for loss of material due to cladding breach. The GALL Report recommends further evaluation by a plant-specific AMP to ensure that the aging effect is adequately managed. The applicant stated that this item is not applicable because the ESF systems do not contain steel pump casings with stainless steel cladding that are exposed to treated borated water and subject to an AMR.

The staff reviewed LRA Sections 2.3.2 and 3.2 and the USAR and confirmed that no in-scope steel with stainless steel cladding pump casing exposed to treated borated water are present in the auxiliary system; therefore, the staff finds the applicant's claim acceptable.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3 against the following criteria in SRP-LR Section 3.2.2.2.3:

(1) LRA Section 3.2.2.2.3.1, associated with LRA Table 3.2.1, item 3.2.1-3, addresses internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water, which are being managed for loss of material due to pitting and crevice corrosion by the PWR Water Chemistry and One-Time Inspection Programs. The criteria in SRP-LR Section 3.2.2.2.3, item 1, states that loss of material due to pitting and crevice corrosion could occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The SRP-LR states that the Water Chemistry Program relies on monitoring and control of water chemistry to mitigate degradation. The SRP-LR also states that a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or progressing very slowly, such that the component's intended function will be maintained during the period of extended operation. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to pitting and crevice corrosion of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water in the ESF systems will be managed by the PWR Water Chemistry and One-Time Inspection Programs.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-03, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs is acceptable because (1) the PWR Water Chemistry Program uses chemical sampling and corrective actions to ensure that impurities are minimized to reduce aging due to loss of material, and (2) the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion, consistent with the recommendations in the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meets the criteria in SRP-LR Section 3.2.2.2.3, item 1. For those items that apply to LRA Section 3.2.2.2.3.1, the staff determined that the LRA is consistent with the GALL

Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.2.2.2.3.2, associated with LRA Table 3.2.1, item 3.2.1-4, addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to soil. The applicant stated that this item is not applicable because there are no stainless steel piping, piping components, or piping elements in the ESF systems that are exposed to soil. The staff reviewed LRA Sections 2.3.2 and 3.2 and the applicant's USAR and confirmed that no in-scope stainless steel piping, piping components, and piping elements exposed to soil are present in the ESF systems; therefore, it finds the applicant's determination acceptable.

(3) LRA Section 3.2.2.2.3.3, associated with LRA Table 3.2.1, item 3.2.1-5, addresses loss of material due to pitting and crevice corrosion in stainless steel and aluminum BWR piping, piping components, and piping elements exposed to treated water. The applicant stated that this item is not applicable because loss of material for these BWR components is only applicable to BWR plants. The staff reviewed the SRP-LR and LRA Section 3.2 and noted that this item is associated only with BWRs; therefore, it finds the applicant's determination acceptable.

(4) LRA Section 3.2.2.2.3.4, associated with LRA Table 3.2.1, item 3.2.1-6, addresses stainless steel and copper-alloy piping, piping components, and piping elements exposed to lubricating oil, which are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will provide verification of the effectiveness of the Lubricating Oil Analysis Program by managing loss of material through periodic monitoring and control of contaminants, including water. The applicant further stated that the ESF systems do not contain copper-alloy piping, piping components, or piping elements that are exposed to lubricating oil and subject to an AMR. However, this item is applied to copper-alloy heat exchanger components.

The staff reviewed LRA Section 3.2.2.2.3.4 against the criteria in SRP-LR Section 3.2.2.2.3, item 4, which state 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 staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-6, that staff finds the applicant's proposal to manage aging using the One-Time Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to examine stainless steel piping and copper-alloy piping components exposed to lube oil to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.2.2.2.3, item 4; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, item 4, criteria. For the AMR items that apply to LRA

Section 3.2.2.2.3.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(5) LRA Section 3.2.2.2.3.5, associated with LRA Table 3.2.1, item 3.2.1-7, addresses loss of material due to pitting and crevice corrosion in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The applicant stated that this item is not applicable because there are no partially encased stainless steel tanks in the ESF systems that are exposed to raw water. The staff reviewed LRA Sections 2.3.2 and 3.2 and the applicant's USAR and confirmed that no in-scope partially encased stainless steel tanks exposed to raw water are present in the ESF systems; therefore, it finds the applicant's determination acceptable.

(6) LRA Section 3.2.2.2.3.6, associated with LRA Table 3.2.1, item 3.2.1-8, addresses stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation, which are being managed for loss of material due to pitting and crevice corrosion by the One-Time Inspection Program. The criteria in SRP-LR Section 3.2.2.2.3, item 6, states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The SRP-LR also states that the GALL Report recommends a plant-specific AMP to ensure that the aging effect is adequately managed; however, the GALL Report, Revision 2, recommends that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program be used. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to pitting and crevice corrosion of stainless steel piping components exposed to moist air in the ESF systems will be managed by the One-Time Inspection Program.

The GALL Report, Revision 2, item V.D1.EP-81, recommends that for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation, loss of material due to pitting and crevice corrosion be managed by GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." GALL Report AMP XI.M38 includes opportunistic visual inspections of components whenever the components are made available for inspection. However, in LRA Table 3.2.1, item 3.2.1-08, the applicant instead proposes to use its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.2.3.6-1 requesting that the applicant provide justification for its use of the One-Time Inspection Program for managing this aging effect.

In its response dated June 3, 2011, the applicant stated that Amendment No. 7 to the LRA changed the AMP used for the condensation environment to the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also stated that the One-Time Inspection Program will still be used to verify the effectiveness of the AMPs credited for managing aging effects above and below the air/water interface.

The staff reviewed the applicant's response and could not confirm, for two items for which the One-Time Inspection Program was retained, that the applicant will age manage the internal surfaces above the air/water interface exposed to condensation (i.e., there are no AMR items for the upper portions of the associated tanks). In addition, the staff noted that Amendment No. 7 did not address all of the items associated with RAI 3.2.2.2.3.6-1, including components in the containment spray system, core flooding system, DHR and LPI system, CCW system, and demineralized water storage system. By letter dated July 12, 2011, the staff issued RAI 3.2.2.2.3.6-2 requesting that the applicant state how loss of material will be managed for those components that lacked an AMR item for the internal surfaces above the air/water interface as well as for those components that were not addressed in the applicant's response to RAI 3.2.2.2.3.6-1.

In its response dated August 17, 2011, the applicant modified the LRA to age manage the internal surfaces of components that previously lacked an AMR item for loss of material above the air/water interface using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also stated that components that reference item 3.2.1-08 will be managed for loss of material by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program.

The staff finds the applicant's response acceptable because the applicant modified the LRA to manage stainless steel components exposed to moist air using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, which includes opportunistic visual inspections that are capable of detecting loss of material. The staff's concerns described in RAIs 3.2.2.2.3.6-1 and 3.2.2.2.6-2 are resolved.

The staff's evaluation of the applicant's Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. In its review of components associated with item 3.2.1-8, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the Internal Surfaces in Miscellaneous Piping and Ducting Program is acceptable because the program includes visual inspections, which are capable of detecting loss of material. The visual inspections will be performed by a qualified personnel, and the visual inspections will be supplemented by other NDE techniques, as appropriate.

Based on the program identified, the staff concludes that the applicant's program meets the criteria in SRP-LR Section 3.2.2.2.3, item 6. For those items that apply to LRA Section 3.2.2.2.3.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3 criteria. For those AMR items that apply to LRA Section 3.2.2.2.3, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain 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 3.2.2.2.4.1, associated with LRA Table 3.2.1, item 3.2.1-9, addresses steel, stainless steel, and copper-alloy heat exchanger tubes exposed to lubricating oil, which are being managed for reduction of heat transfer due to fouling by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the

SRP-LR by stating that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of heat transfer through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.2.2.2.4.1 against the criteria in SRP-LR Section 3.2.2.2.4, item 1, which state 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 staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-9, the staff finds the applicant's proposal to manage aging using the One-Time Inspection Program and the Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to provide verification of the effectiveness of the Lubricating Oil Analysis Program to manage reduction in heat transfer due to fouling. This satisfies the acceptance criteria in SRP-LR Section 3.2.2.2.4, item 1; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4, item 1, criteria. For the AMR items that apply to LRA Section 3.2.2.2.4.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.2.2.2.4, item 2, associated with LRA Table 3.2.1, item 3.2.1-10, addresses stainless steel heat exchanger tubes exposed to treated water, which are being managed for reduction of heat transfer due to fouling by the PWR Water Chemistry and One-Time Inspection Programs. The criteria in SRP-LR Section 3.2.2.2.4, item 2, states that reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The SRP-LR also states that the existing AMP controls water chemistry to mitigate this aging effect, and the effectiveness should be confirmed because the water chemistry controls may not be effective in precluding fouling. The SRP-LR further states that a one-time inspection of selected components at susceptible locations is an acceptable method to verify the program's effectiveness. The applicant addressed the further evaluation criteria of the SRP-LR by stating that it will implement the One-Time Inspection Program to verify the effectiveness of the PWR Water Chemistry Program to manage reduction of heat transfer due to fouling in the ESF systems exposed to treated water.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-10, the staff finds that the applicant met the further review criteria. In addition, the staff finds that the applicant's proposal to manage aging using the specified AMPs is acceptable because (1) the PWR Water Chemistry Program includes periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits to mitigate fouling, and

(2) the One-Time Inspection Program will verify the effectiveness of the PWR Water Chemistry Program to manage this aging effect.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4, item 2, criteria. For those items that apply to LRA Section 3.2.2.2.4 item 2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4 criteria. For those AMR items that apply to LRA Section 3.2.2.2.4, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain 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

LRA Section 3.2.2.2.5, associated with LRA Table 3.2.1, item3.2.1-11, addresses hardening and loss of strength due to elastomer degradation. The applicant stated that this aging effect is applicable to BWR plants only and, therefore, is not applicable to Davis-Besse. 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 uncontrolled indoor air. This item is not applicable to Davis-Besse because it is a PWR. On this basis, the staff finds that SRP-LR Section 3.2.2.2.5 criteria do not apply to Davis-Besse; therefore, the staff finds the applicant's determination acceptable.

3.2.2.2.6 Loss of Material Due to Erosion

LRA Section 3.2.2.2.6, associated with LRA Table 3.2.1, item 3.2.1-12, addresses stainless steel minimum flow orifices in the HPSI system exposed to treated borated water, which are being managed for loss of material due to erosion by the PWR Water Chemistry and the One-Time Inspection Programs. However, LRA Table 3.2.1, item 3.2.1-12, states that this item is not applicable and that loss of material due to erosion for these components is addressed through item 3.2.1-49, which credits these AMPs. The criteria in SRP-LR Section 3.2.2.2.6 states that loss of material due to erosion could occur in HPSI pump minimum flow orifices exposed to treated borated water. The SRP-LR also states that a plant-specific AMP should be evaluated for erosion of the orifice due to extended use of this pump for normal charging. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to erosion could occur in the stainless steel high-pressure safety injection (HPSI) pump minimum flow recirculation orifice exposed to treated borated water, but it added that the safety-related HPI pump is not used for normal charging and is normally in standby.

Because of the applicant's reference to item 3.2.1-49 in its evaluation of item 3.2.1-12, the staff also reviewed LRA Table 3.2.1, item 3.2.1-49, and associated components. The staff noted that item 3.2.1-49 provides AMR results for stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water that have an aging effect/mechanism of loss of material due to pitting and crevice corrosion, rather than loss of material due to erosion. The staff also noted that although the aging effect is the same for items 3.2.1-12 and 3.2.1-49, the mechanisms causing loss of material are different. The staff further noted that LRA

Table 3.2.2-5 for the HPI system includes AMR items for stainless steel orifices exposed to treated borated water associated with Table 3.2.1, item 3.2.1-49, that have an intended function of throttling and an aging effect of loss of material, but the aging mechanism that causes loss of material in these orifices is not identified.

By letter dated May 2, 2011, the staff issued RAI 3.2.2.2.6-1, asking the applicant to clarify and justify its proposed programs for management of loss of material due to erosion in the minimum flow recirculation orifices for the HPI and high-pressure makeup pumps. In its response dated June 3, 2011, the applicant stated that its AMR did not identify loss of material due to erosion as an AERM in the minimum flow recirculation orifices associated with the HPI pumps. The applicant revised LRA Section 3.2.2.2.6 to state that loss of material due to erosion is not applicable to the HPI pumps' minimum flow orifices because these pumps are not used for normal charging and are normally in standby. The applicant also deleted the previous discussion of normal charging pump orifices from LRA Section 3.2.2.2.6 and LRA Table 3.2.1, item 3.2.1-12.

The staff reviewed the applicant's license renewal boundary drawings for the HPI and the makeup and purification systems and the description of makeup and purification system operation in the USAR. Based on its review of the drawings and the USAR description, the staff noted that normal charging for the HPI system is provided by a pump in the makeup and purification system, not by the HPI system pumps. The staff also noted that a check valve arrangement shown on the drawings prevents normal charging flow provided by the makeup and purification pump from going through the minimum flow orifices of the HPI pumps. The staff finds the applicant's response acceptable for the following reasons:

- The HPI pumps are normally in standby.
- In the standby alignment, there is no flow through the minimum flow recirculation orifices for the HPI pumps.
- With no flow through the minimum flow recirculation orifices, there is no mechanical interaction with moving fluid to cause erosion of those orifices.

The staff's concern described in RAI 3.2.2.2.6-1 is resolved. Therefore, the staff finds that this item and AMR are not applicable.

The staff reviewed LRA Section 3.2.2.2.6 and the USAR and finds that the criteria in SRP-LR Section 3.2.2.2.6 do not apply to Davis-Besse; therefore, the staff finds the applicant's determination to be acceptable.

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

LRA Section 3.2.2.2.7, associated with LRA Table 3.2.1, item 3.2.1-13, addresses loss of material due to general corrosion and fouling in BWR steel drywell and suppression chamber components exposed to uncontrolled indoor air. The applicant stated that this item is not applicable because loss of material for these BWR components is only applicable to BWR plants. The staff reviewed the SRP-LR and LRA Section 3.2 and noted that this item is associated only with BWRs; therefore, it finds the applicant's determination acceptable.

Based on information above, the staff concludes that the criteria in SRP-LR Section 3.2.2.2.7 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 following criteria in SRP-LR Section 3.2.2.2.8:

(1) LRA Section 3.2.2.2.8.1, associated with LRA Table 3.2.1, item 3.2.1-14, addresses loss of material due to general, pitting, and crevice corrosion in steel BWR piping, piping components, and piping elements exposed to treated water. The applicant stated that this item is not applicable because loss of material for these BWR components is only applicable to BWR plants. The staff reviewed the SRP-LR and LRA Section 3.2 and noted that this item is associated only with BWRs; therefore, it finds the applicant's determination acceptable.

(2) LRA Section 3.2.2.2.8.2, associated with LRA Table 3.2.1, item 3.2.1-15, addresses loss of material due to general, pitting, and crevice corrosion in the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The applicant stated that this item is not applicable because the ESF systems do not contain steel containment isolation piping, piping components, or piping elements exposed to treated water and subject to an AMR. The staff reviewed LRA Sections 2.3.2 and 3.2 and the USAR and confirmed that no in-scope steel piping, piping components, and piping elements exposed to treated water are present in the ESF systems; therefore, it finds the applicant's determination acceptable.

(3) LRA Section 3.2.2.2.8.3, associated with LRA Table 3.2.1, item 3.2.1-16, addresses steel piping, steel (including gray cast iron) heat exchanger components, piping components, and piping elements exposed to lubricating oil, which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis Program. The applicant stated that this item is also applied to loss of material due to selective leaching for gray cast iron components that are exposed to lubricating oil. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.2.2.2.8.3 against the criteria in SRP-LR Section 3.2.2.2.8, item 3, which state that loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion.

The staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.2.1-16, the staff finds the applicant's proposal to manage aging using the One-Time Inspection Program and the Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR

Section 3.2.2.2.8, item 3; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8, item 3, criteria. For the AMR items that apply to LRA Section 3.2.2.2.8.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain 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 following criteria in SRP-LR Section 3.2.2.2.9.

LRA Section 3.2.2.2.9, associated with LRA Table 3.2.1, item 3.2.1-17, addresses loss of material due to general, pitting, and crevice corrosion, and MIC in steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil. The applicant stated that this item is not applicable because there are no steel (with or without coating or wrapping) piping, piping components, or piping elements in the ESF systems that are exposed to soil. The staff reviewed LRA Sections 2.3.2 and 3.2 and the applicant's USAR and confirmed that no in-scope steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil are present in the ESF systems; therefore, it finds the applicant's claim acceptable.

3.2.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.2.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-5, 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 3.2.2-5, the applicant indicated, via notes F–J, that the combination of component type, material, environment, and AERM does not correspond to an item in the GALL Report. The applicant provided further information concerning how the aging effects will be managed. Specifically, note F indicates that the material for the AMR item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the AMR item component, material, and environment combination is not applicable.

Note J indicates that neither the component nor the material and environment combination for the AMR 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 if the applicant demonstrated that the aging effects will be adequately managed so that the intended function(s) will remain 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 Systems—Containment Air Cooling and Recirculation System—Aging Management Review Results—LRA Table 3.2.2-1

In LRA Tables 3.2.2-1, 3.2.2-2, 3.2.2-3, 3.2.2-4, and 3.2.2-5, the applicant stated that the stainless steel bolting exposed to air with steam or water leakage (external) are being managed for loss of material and cracking by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Report Table IX.C states that stainless steels are susceptible to loss of material due to pitting and crevice corrosion and cracking due to SCC. GALL Report AMP XI.M18, "Bolting Integrity," also indicates that a loss of preload is an aging effect that is monitored for bolting materials. The loss of preload aging effect is the subject of an RAI as discussed below. Thus, the aging effects of concern are loss of material and cracking, which are addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because it will use periodic visual inspections that would detect loss of material and cracking prior to loss of component intended function.

The staff noted that the applicant did not reference loss of preload in LRA Tables 3.2.2-1, 3.2.2-3, 3.2.2-4, 3.2.2-5, 3.3.2-4, 3.3.2-5, 3.3.2-7, 3.3.2-8, 3.3.2-11, 3.3.2-14, 3.3.2-16, 3.3.2-18, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-26, 3.3.2-31, and 3.4.2-1 as an aging effect for stainless steel bolting exposed to air with steam or water leakage (external). By letter dated May 19, 2011, the staff issued RAI B.2.4-4 requesting that the applicant justify why it did not address the aging effect of loss of preload.

In its response dated June 24, 2011, the applicant stated that stainless steel bolts exposed to air are being managed for loss of preload by the Bolting Integrity Program. The applicant also stated that the presence of steam or water leakage in the air environment does not alter the need to manage for loss of preload nor the program that will manage bolting integrity. The applicant further stated that the Bolting Integrity Program includes periodic inspection of bolted closures and connections for signs of degradation such as leakage, loss of material due to corrosion, loss of preload, and cracking due to SCC, as well as preventive measures to preclude or minimize loss of preload and cracking. The staff further discussed the issue with the applicant via teleconference dated June 29, 2011, and received clarification from the applicant that AMR items already exist in the LRA, which manage stainless steel bolting exposed to an air-indoor uncontrolled environment for loss of preload. The applicant further explained that although the environments do not match, the air-indoor uncontrolled environment represents a more conservative approach to managing the loss of preload aging effect and would ensure that all in-scope stainless steel bolts in the system would be managed for loss of preload by the Bolting Integrity Program. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload, and inspects for leakage and loose or missing nuts, which verify that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation. The staff's concern described in RAI B.2.4-4 is resolved.

In LRA Tables 3.2.2-1, 3.2.2-2, 3.2.2-3, 3.2.2-4, and 3.2.2-5, the applicant stated that the stainless steel bolting exposed to air-indoor uncontrolled (external) are being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because even though stainless steel bolting exposed to air-indoor is not specifically addressed in the GALL Report, Table IX.E, the GALL Report states that loss of preload can occur independent of environmental conditions because it can be caused by thermal or mechanical effects. Additionally, Table IX.C of the GALL Report states that stainless steel material is susceptible to a variety of aging effects and mechanisms, including loss of material due to pitting and crevice corrosion and cracking due to SCC. The staff noted that the environment of interest, air-indoor, would not induce SCC or loss of material in stainless steel material because stainless steel is inherently resistant to corrosion in the air-indoor environment. Therefore, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts, which verifies that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

In LRA Table 3.2.2-1, the applicant stated that the copper-alloy heat exchanger air cooling coil components exposed to condensation (external) are being managed for reduction in heat transfer by the One-Time Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. Based on its review of the GALL Report, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination because the GALL Report states that heat exchanger components are susceptible to loss of material and reduction of heat transfer, and this component is being managed for loss of material in another AMR item in LRA Table 3.2.2-1.

The GALL Report recommends the periodic XI.M20, "Open-Cycle Cooling Water System," to manage loss of material or reduction in heat transfer for these components and material exposed to raw water. Based on LRA Table 3.0-1, "Process Environments," a plant environment of condensation relates to a GALL Report environment of raw water. While the condensation (external) environment is an accumulation of moisture rather than a raw water system, the staff believes that a periodic-based management program is still recommended. In LRA Table 3.2.2-1, the applicant proposed to use its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects versus a periodic program.

In its response dated June 3, 2011, the applicant stated that it revised the LRA to manage this aging effect using the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program as part of its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response and its proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable because the program includes visual periodic opportunistic inspections, which are capable of managing reduction of heat transfer through the period of extended operation. The staff's concern described in RAI 3.2.2.1.26-1 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Engineered Safety Features Systems—Containment Spray System—Aging Management Review Results—LRA Table 3.2.2-2

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which are being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which are being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

In LRA Table 3.2.2-2, the applicant stated that the stainless steel piping components exposed to moist air (internal) are being managed for cracking by the One-Time Inspection Program. The AMR items cite generic note H. The AMR item also cites plant-specific note 0202, which states that the One-Time Inspection Program is being used to confirm the absence of aging effects or to confirm that aging is slow acting so as to not affect the subject component's intended function during the period of extended operation.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that GALL Report, Table IX.C states that stainless steel components are susceptible to loss of material and SCC. The staff also noted that the applicant addressed both GALL Report identified aging effects for this component, material, and environment combination in LRA Table 3.2.2-2. Based on its review of the GALL Report, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the One-Time Inspection Program is intended to confirm the absence of aging effects or confirm that aging is progressing very slowly. The staff also noted that a moist air environment can be inconsistent over time, resulting in aging effects that may not occur consistently and may not be identified by a one-time inspection. However, in LRA Table 3.2.2-2, the applicant instead proposed to use its One-Time Inspection Program to manage cracking for components exposed to moist air. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that this item would be deleted. The applicant also stated that the One-Time Inspection Program is still credited to confirm the absence of aging effects at the air-water interface when an appropriate program is being used to manage the surface below the air-water interface and a periodic program is being used to manage the surface above the air-water interface. However, the staff noted that the LRA amendment in letter dated May 24, 2011, did not include evidence that this item was deleted from LRA Table 3.2.2-2. The staff finds the applicant's response not acceptable because the applicant did not identify the periodic program used above the air-water interface to managing aging, and it is unclear to staff whether this item was actually deleted. By letter dated July 12, 2011, the staff issued RAI 3.2.2.2.3.6-2 requesting that the applicant state how it will manage those items that were not addressed in the LRA amendment.

In its response dated August 17, 2011, the applicant did not address or delete Table 3.2.2-2, Row 20, for stainless steel piping exposed to moist air (internal) being managed for cracking. In a teleconference dated August 22, 2011, the applicant stated that the item was intended to be deleted but documentation had not yet been provided. However, in its subsequent response, dated September 16, 2011, the applicant stated that this AMR item is not deleted and should not be deleted. The applicant also stated that cracking of the subject stainless steel piping exposed to moist air will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting program. As part of an extent of condition review, additional LRA changes were made to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program in lieu of a one-time inspection to manage loss of material for components in a moist air environment. Furthermore, the applicant stated that the moist air (internal) environment encompasses both the air-water interface and the air environment above the interface, and credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material (except for selective leaching) and cracking for all in-scope components subject to a moist air environment.

The staff finds the applicant's response and its proposal to manage aging at and above the air-water interface using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable because the program includes visual opportunistic inspections that are capable of identifying loss of material prior to loss of intended function and are performed at an appropriate frequency to identify aging effects that may occur in an inconsistent environment. The staff's concerns described in RAIs 3.2.2.1.26-1and 3.2.2.2.3.6-2 are resolved.

In LRA Table 3.2.2-2, the applicant stated that steel piping components exposed to air (internal) are being managed for loss of material by the One-Time Inspection Program. The AMR items cite generic note G. The AMR item also cites plant-specific note 0203, which states that the One-Time Inspection Program is being used to confirm the absence of aging effects or to confirm that aging is slow acting so as to not affect the subject component's intended function during the period of extended operation.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. Based on its review of the GALL Report, which states that steel materials in this environment are susceptible to loss of material due to general, pitting and crevice corrosion, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The GALL Report recommends AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” to manage loss of material for this component, material, and environment combination. However, in LRA Table 3.2.2-2, the applicant instead proposed to use its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that it revised the LRA to manage loss of material for steel piping exposed to air using the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program as part of its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff’s evaluation of the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant’s response, and its proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because the program includes visual opportunistic inspections, which are capable of managing loss of material through the period of extended operation. The staff’s concern described in RAI 3.2.2.1.26-1 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Engineered Safety Features Systems—Core Flooding System—Aging Management Review Results—LRA Table 3.2.2-3

The staff’s evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which are being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

The staff’s evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which are being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

In LRA Table 3.2.2-3, row 14, the applicant stated that nickel-alloy nozzles of the core flood tanks exposed to gas (internal) are not required to be managed for aging. The AMR item cites generic note G.

The staff reviewed the associated item in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material for this component, material, and environment combination in AMR items in LRA Table 3.2.2-3, rows 15–18. Based on the staff’s review of operating experience, NUREG-1823, “U.S. Plant Experience With Alloy 600 Cracking and Boric Acid Corrosion of Light-Water Reactor Pressure Vessel Materials,” and research under various gas conditions discussed in “Heat-Resistant Materials,” American Society for Metals (ASM) International, 1997, which establish that no degradation mechanisms are applicable at the operating temperature ranges and stress conditions for this component, the staff finds that the applicant identified all credible aging effects, in this case none, for this component, material, and environment combination. Regardless, this item, nickel-alloy nozzle of the core flood tanks, will be maintained under the applicant's PWR Water Chemistry and One-Time Inspection Programs under other AMR items.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff finds the nozzles in question are of a robust design and made of a material generally resistant to aging effects under these operating conditions. The staff finds the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs acceptable because effective water chemistry control and a one-time inspection provide reasonable assurance of structural integrity for this component under its operating conditions.

In LRA Table 3.2.2-3, the applicant stated that nickel-alloy nozzles in the core flood tanks exposed to treated borated water are being managed for loss of material by the PWR Water Chemistry Program and One-Time Inspection Program. The AMR items cite generic note G. The AMR items also cite plant-specific note 0208, which states that the One-Time Inspection will provide verification of the PWR Water Chemistry Program's effectiveness.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. Based on its review of the *American Society of Metals International Materials Handbook* and the GALL Report, which state that nickel alloys are designed to be resistant to aqueous corrosion but are susceptible to loss of material, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's PWR Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff finds the applicant's proposal to manage aging using PWR Water Chemistry and One-Time Inspection Programs acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate aging and identifies the actions required if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes one-time visual inspections, volumetric inspections, and surface inspection techniques inspections, as determined by engineering, of select components to verify the effectiveness of the PWR Water Chemistry Program for managing the effects of aging due to loss of material.

In LRA Table 3.2.2-3, the applicant stated that nickel-alloy nozzles of the core flood tanks exposed to treated borated water are being managed for loss of material by the PWR Water Chemistry Program. The AMR item cites generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material for this component, material, and environment combination in AMR items in LRA Table 3.2.2-3, rows 15 and 18. Based on the staff's review of operating experience and NUREG-1823, "U.S. Plant Experience With Alloy 600 Cracking and Boric Acid Corrosion of Light-Water Reactor Pressure Vessel Materials," which establish that other potential degradation mechanisms are not applicable due to temperature ranges and stress conditions which this component would be expected to see during operation, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's PWR Water Chemistry Program is documented in SER Section 3.0.3.1.15. The staff finds the nozzles in question are of a robust design and made of a material generally resistant to aging effects under these operating conditions. The staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program acceptable because effective water chemistry control provides reasonable assurance that structural integrity for this component will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.2.2-3, the applicant stated that nickel-alloy nozzles of the core flood tanks exposed to air with borated water leakage (external) are not required to be managed for aging. The AMR item cites generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material for this component, material, and environment combination in AMR items in LRA Table 3.2.2-3, rows 14–16 and 18. Based on the staff's review of the GALL Report, Revision 2, which states in item V.F.EP-115 that nickel alloys under air with borated water leakage have no aging effect mechanism, the applicant's assessment for this component and environment is complete. The GALL Report, Revision 2, is based on data contained in EPRI Report 1000975, "Boric Acid Corrosion Guidebook, Revision 1." This EPRI report contains data (pages 4–43) showing that "[t]here was no measurable corrosion of stainless steel piping surfaces or Inconel weld metal joining the stainless steel and carbon steel piping sections." Therefore, the staff finds that the applicant identified all credible aging effects—in this case none—for this component, material, and environment combination. Regardless, this item, nickel-alloy nozzle of the core flood tanks, will be maintained under the applicant's PWR Water Chemistry and One-Time Inspection Programs under other AMR items.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff finds the nozzles in question are of a robust design and made of a material generally resistant to aging effects under these operating conditions. The staff finds the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs acceptable because effective water chemistry control and a one-time inspection provide reasonable assurance of structural integrity for this component under its operating conditions.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.4 Engineered Safety Features Systems—Decay Heat Removal and Low-Pressure Injection System—Aging Management Review Results—LRA Table 3.2.2-4

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which are being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which are being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

In LRA Tables 3.2.2-4 and 3.2.2-5, the applicant stated that the stainless steel bolting exposed to air-outdoor (external) are being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Report Table IX.C states that stainless steels are susceptible to cracking due to SCC. GALL Report Table IX.E states that loss of preload can occur independent of environmental conditions because it can be caused by thermal or mechanical effects. The staff noted that the applicant's site is close to a major road, which has the potential for salt accumulation and is susceptible to SCC. The cracking aging effect is the subject of an RAI as discussed below. Thus, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control, such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts, which verifies that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

The staff noted that the applicant did not reference loss of material and SCC, in LRA Tables 3.2.2-4 and 3.2.2-5, as aging effects for stainless steel bolting exposed to air-outdoor (external). By letter dated May 19, 2011, the staff issued RAI 3.2.2.2.6-2 requesting that the applicant justify why it did not reference these aging effects.

In its response dated June 24, 2011, the applicant stated that for stainless steel bolting, the air-outdoor environment may result in an atmospheric chloride induced loss of material due to pitting and crevice corrosion and cracking due to SCC aging effects on stainless steel. The applicant amended the LRA to credit the Bolting Integrity Program to manage loss of material and cracking of stainless steel bolting subject to an outdoor air environment. The staff finds the applicant's proposal to manage aging using the Bolting integrity Program acceptable because it will use periodic visual inspections that would detect loss of material and cracking prior to loss of component intended function. The staff's concern described in RAI 3.2.2.2.6-2 is resolved.

In LRA Tables 3.2.2-4 and 3.2.2-5, the applicant stated that for stainless steel piping, tubing, and valve bodies exposed to air-outdoor (external), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and noted that loss of material and cracking can occur in stainless steel components exposed to air-outdoor (external) depending on whether the outdoor air environment is within 1/2 mile (mi) of a highway that is treated with salt in the wintertime, the soil contains more than a trace amount of chlorides, the plant has cooling towers where the water is treated with chlorine or chlorine compounds, or the area is subject to chloride contamination from other agricultural or industrial sources. By letter dated May 2, 2011, the staff issued RAI 3.2.2.3.4-2 requesting that the applicant state why the specific environment, air-outdoor (external), will not induce loss of material or cracking in stainless steel components.

In its response dated June 3, 2011, the applicant stated that the stainless steel components exposed to outdoor air, listed in LRA Tables 3.2.2-4 and 3.2.2-5, were addressed in its response to RAI B.2.2-2 dated May 24, 2011, which revised the LRA to credit the External Surfaces Monitoring Program to manage loss of material and cracking for stainless steel components exposed to outdoor air in the DHR systems, LPI systems, and HPI system. The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff finds the applicant's response, and its proposal to manage loss of material and cracking for stainless steel components exposed to outdoor air using the External Surfaces Monitoring Program, acceptable because the applicant will manage aging for these components using periodic visual inspections, which are capable of detecting loss of material and cracking. The staff's concern described in RAI 3.2.2.3.4-2 is resolved.

In LRA Table 3.2.2-4 the applicant stated that for the stainless steel BWST exposed to air-outdoor (external) there is no aging effect, and no AMP is proposed. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and noted that loss of material and cracking can occur in stainless steel components exposed to air-outdoor (external) depending on whether the outdoor air environment is within 1/2 mi of a highway that is treated with salt in the wintertime, the soil contains more than a trace amount of chlorides, the plant has cooling towers where the water is treated with chlorine or chlorine compounds, or the area is subject to chloride contamination from other agricultural or industrial sources. During the AMP audit walkdown, the staff also noted that the BWST is coated with insulation material. The staff further noted that there is no information in the LRA or USAR regarding the susceptibility of the insulation on the BWST to release halides, which could result in cracking of the stainless steel tank. By letter dated April 20, 2011, the staff issued RAI B.2.2-2 requesting that the applicant state why the air-outdoor environment will not result in an AERM for the stainless steel BWST, describe the insulation material applied on the external surface of the stainless steel BWST, and state if it could release halides. If the outdoor air environment or insulation could result in an AERM, the staff asked the applicant to state how the aging effect will be managed.

In its response dated May 24, 2011, the applicant stated that the conditions described in the RAI exist such that the air-outdoor environment may result in an AERM for the stainless steel BWST. The applicant revised the LRA to credit the Aboveground Storage Tanks Inspection Program and External Surfaces Monitoring Program to manage loss of material for the BWST and the Aboveground Storage Tanks Inspection Program to manage cracking. The applicant added plant-specific note 0212 to clarify that the Aboveground Storage Tanks Inspection Program will manage aging at the interface between the tank and foundation, and the External Surfaces Monitoring Program will manage aging for the external surfaces above the foundation. The staff finds the applicant's response, and its proposal to manage loss of material and cracking for the stainless steel BWST using the Aboveground Steel Tank Inspection and External Surfaces Monitoring Programs, acceptable because the combination of programs will provide for periodic inspections of the tank external surfaces and foundation, which are capable of detecting loss of material and cracking. Additionally, the staff finds that periodic volumetric examinations of the tank bottom will detect any loss of material from the tank bottom. The staff's concern described in RAI B.2.2-2 is resolved.

In LRA Table 3.2.2-4, the applicant stated that the gray cast iron DHR pump bearing oil cooler heat exchanger housing exposed to closed cooling water is being managed for reduction of heat transfer by the Closed Cooling Water Chemistry Program. The AMR item cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, item V.D1-20 (EP-52), which addresses gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water. GALL Report, item V.D1-20 (EP-52) recommends the Selective Leaching of Materials Program to manage loss of material due to selective leaching. GALL Report, item V.D1-6 (E-17) addresses steel heat exchanger components exposed to closed-cycle cooling water and recommends the Closed-Cycle Cooling Water System Program to manage loss of material due to general, pitting, crevice, and galvanic corrosion. The staff also noted that the applicant addressed these GALL Report identified aging effects for this component, material, and environment combination in AMR items in LRA Table 3.2.2-4.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. The staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on reduction of heat transfer due to fouling, and the periodic inspections can detect the presence or extent of fouling prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report.

In LRA Table 3.2.2-4, the applicant stated that for aluminum valve bodies exposed to outdoor air (external), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that for the material and environment of interest—aluminum and outdoor air (external)—the GALL Report, Revision 2, Tables V.E. and VII.I, recommend AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," to manage the aging effects of loss of material due to pitting and crevice corrosion for aluminum components. The staff further noted that as described in Metals Handbook, Volume 13, "Corrosion," 9th Edition, by the ASM, corrosion of aluminum in the passive range is usually manifested by random formation of pits. By letter dated May 2, 2011, the staff issued RAI 3.2.2.3.4-1, requesting that the applicant justify why the specific environment, outdoor air (external), will not induce loss of material in aluminum.

In its response dated June 3, 2011, the applicant stated that loss of material due to crevice or pitting corrosion could not be ruled out for aluminum components exposed to an outdoor air environment. The applicant further stated that its External Surfaces Monitoring Program has been revised to include the management of aging for the aforementioned aluminum components exposed to an outdoor air environment through periodic visual inspections and surveillance activities. The staff finds the applicant's response acceptable because, consistent with the recommendations of the GALL Report, crevice and pitting corrosion can be detected by the periodic visual inspections under the External Surfaces Monitoring Program. The staff's concern described in RAI 3.2.2.3.4-1 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.5 Engineered Safety Features Systems—High-Pressure Injection System—Aging Management Review Results—LRA Table 3.2.2-5

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which are being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which are being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for stainless steel bolting exposed to air-outdoor (external), which are being managed for loss of preload, loss of material, and cracking due to SCC by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.2.2.3.4.

The staff's evaluation for stainless steel piping, tubing, and valve bodies exposed to air-outdoor (external), for which the applicant stated there is no aging effect, for which the applicant proposed no AMP, and for which the applicant cited generic note G, is documented in SER Section 3.2.2.3.4.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concludes that the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups of the following systems:

- auxiliary building heating, ventilation, and air conditioning (HVAC) systems
- auxiliary building chilled water system
- auxiliary steam and station heating system
- boron recovery system
- chemical addition system
- circulating water system
- CCW system
- containment hydrogen control system
- containment purge system
- containment vacuum relief system
- demineralized water storage system
- EDGs system
- emergency ventilation system

- fire protection system
- fuel oil system
- gaseous radwaste system
- instrument air system
- makeup and purification system
- makeup water treatment system
- miscellaneous building HVAC system
- miscellaneous liquid radwaste system
- nitrogen gas system
- process and area radiation monitoring system
- reactor coolant vent and drain system
- sampling system
- service water system
- SFP cooling and cleanup system
- spent resin transfer system
- station air system
- SBODG system
- station plumbing, drains, and sumps system
- turbine plant cooling water 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 Evaluated in Chapter VII of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff 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 identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Sections 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 that the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR items and the plant's operating experience to verify the applicant's claims.

Table 3.3-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.3 and addressed in the GALL Report.

Table 3.3-1. Staff evaluation for auxiliary systems components in the GALL Report

Component group (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	Consistent with GALL Report (see SER Section 3.3.2.2.1)
Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air-indoor uncontrolled, treated borated water or treated water (3.3.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.3.2.2.1)
Stainless steel heat exchanger tubes exposed to treated water (3.3.1-3)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.2.2)

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
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution > 140 °F (> 60 °C) (3.3.1-4)	Cracking due to SCC	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.2.3(1))
Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 140 °F (> 60 °C) (3.3.1-5)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.2.3(2))
Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-6)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.3(3))
Stainless steel non-regenerative heat exchanger components exposed to treated borated water > 140 °F (> 60 °C) (3.3.1-7)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.3 and 3.3.2.2.4(1))
Stainless steel regenerative heat exchanger components exposed to treated borated water > 140 °F (> 60 °C) (3.3.1-8)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.2.4(2))

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel high-pressure pump casing in PWR chemical and volume control system (3.3.1-9)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific AMP is to be evaluated.	Yes	PWR Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (see SER Section 3.3.2.2.4(3))
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-10)	Cracking due to SCC and cyclic loading	Bolting Integrity The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes	Bolting Integrity Program	Consistent with GALL Report (see SER Section 3.3.2.2.4(4))
Elastomer seals and components exposed to air-indoor uncontrolled (internal/external) (3.3.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated.	Yes	External Surfaces Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.5(1))
Elastomer lining exposed to treated water or treated borated water (3.3.1-12)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.5(2))
Boral®, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water (3.3.1-13)	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	A plant-specific AMP is to be evaluated.	Yes	Boral® Monitoring and the PWR 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	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.7(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 RCP oil collection system piping, tubing, and valve bodies exposed to lubricating oil (3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.7(1))
Steel RCP oil collection system tank exposed to lubricating oil (3.3.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.7(1))
Steel piping, piping components, and piping elements exposed to treated water (3.3.1-17)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.7(2))
Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-18)	Loss of material/general (steel only), pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.7(3))
Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil (3.3.1-19)	Loss of material due to general, pitting, crevice, and MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Not applicable Buried Piping and Tanks Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.8)
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 MIC and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.9(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 heat exchanger components exposed to lubricating oil (3.3.1-21)	Loss of material due to general, pitting, crevice, and MIC and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.9(2))
Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water (3.3.1-22)	Loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation)	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.2.10(1))
Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water (3.3.1-23)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.2.10(2))
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-24)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.10(2))
Copper-alloy HVAC piping, piping components, and piping elements exposed to condensation (external) (3.3.1-25)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	External Surfaces Monitoring, Bolting Integrity, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.10(3))
Copper-alloy piping, piping components, and piping elements exposed to lubricating oil (3.3.1-26)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.10(4))

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel HVAC ducting and aluminum HVAC piping, piping components, and piping elements exposed to condensation (3.3.1-27)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	External Surfaces Monitoring, Bolting Integrity, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.10(5))
Copper-alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-28)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.2.10(6))
Stainless steel piping, piping components, and piping elements exposed to soil (3.3.1-29)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.2.10(7))
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution (3.3.1-30)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.2.10(8))
Copper-alloy piping, piping components, and piping elements exposed to treated water (3.3.1-31)	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.2.11)
Stainless steel, aluminum and copper-alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-32)	Loss of material due to pitting, crevice, and MIC	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.12(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 lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and MIC	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.2.12(2))
Elastomer seals and components exposed to air-indoor uncontrolled (internal or external) (3.3.1-34)	Loss of material due to wear	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program and External Surfaces Monitoring Program	Consistent with GALL Report (see SER Section 3.3.2.2.13)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.3.1-35)	Loss of material due to cladding breach	A plant-specific AMP is to be evaluated. Reference NRC IN 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes	Not applicable	Not applicable to Davis-Besse (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 PWRs (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to treated water > 140 °F (> 60 °C) (3.3.1-37)	Cracking due to SCC and intergranular SCC	BWR Reactor Water Cleanup System	No	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.2)
Stainless steel piping, piping components, and piping elements exposed to treated water > 140 °F (> 60 °C) (3.3.1-38)	Cracking due to SCC	BWR SCC and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.1.1)

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 BWR spent fuel storage racks exposed to treated water > 140 °F (> 60 °C) (3.3.1-39)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.1.1)
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 Inspection	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 and SCC	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.3.1-42)	Loss of material due to general corrosion	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel bolting and closure bolting exposed to air-indoor uncontrolled (external) or air-outdoor (external) (3.3.1-43)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel compressed air system closure bolting exposed to condensation (3.3.1-44)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel closure bolting exposed to air-indoor uncontrolled (external) (3.3.1-45)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water > 140 °F (> 60 °C) (3.3.1-46)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.3.2.1.3)
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 Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.3.2.1.4)
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 Cooling Water Chemistry and Selective Leaching Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.5)
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 MIC	Closed-Cycle Cooling Water System	No	Closed Cooling Water Chemistry	Consistent with GALL Report (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 Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.3.2.1.6)

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
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 Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.3.2.1.7)
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 Cooling Water Chemistry	Consistent with GALL Report (see SER Section 3.3.2.1.8)
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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.1.9)
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	Collection, Drainage, and Treatment Components Inspection and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.1.10)
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	Not applicable	Not applicable to Davis-Besse (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 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
Steel external surfaces exposed to air-indoor uncontrolled (external), air-outdoor (external), and condensation (external) (3.3.1-58)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring	Consistent with GALL Report
Steel heat exchanger components exposed to air-indoor uncontrolled (external) or air-outdoor (external) (3.3.1-59)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	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	External Surfaces Monitoring	Consistent with GALL Report
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	External Surfaces Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.1.11)

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
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-62)	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
Steel fire rated doors exposed to air-outdoor or air-indoor uncontrolled (3.3.1-63)	Loss of material due to wear	Fire Protection	No	Fire Protection	Consistent with GALL Report
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 Davis-Besse (see SER Section 3.3.2.1.1)
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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
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	Not applicable	Not applicable to Davis-Besse (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 piping, piping components, and piping elements exposed to raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and MIC and fouling	Fire Water System	No	Fire Water and Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.12)
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 and Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.13)
Copper-alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and MIC and fouling	Fire Water System	No	Fire Water and Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.14)
Steel piping, piping components, and piping elements exposed to moist air or condensation (internal) (3.3.1-71)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.1.15)
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) MIC	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting	Consistent with GALL Report (see SER Section 3.3.2.1.16)
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	Cranes and Hoists Inspection	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 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	Cranes and Hoists Inspection Program	Consistent with GALL Report (see SER Section 3.3.2.1.1)
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	Collection, Drainage and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.17)
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 MIC, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water and Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.18)
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and MIC and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water	Consistent with GALL Report
Stainless steel, nickel-alloy, and copper-alloy piping, piping components, and piping elements exposed to raw water (3.3.1-78)	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System	No	Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.1 and 3.3.3.1.19)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-79)	Loss of material due to pitting and crevice corrosion and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water and Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Sections 3.3.2.1.1 and 3.3.2.1.20)

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 raw water (3.3.1-80)	Loss of material due to pitting, crevice, and MIC	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
Copper-alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and MIC and fouling	Open-Cycle Cooling Water System	No	Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.21)
Copper-alloy heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and MIC and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water	Consistent with GALL Report
Stainless steel and copper-alloy heat exchanger tubes exposed to raw water (3.3.1-83)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water and Collection, Drainage, and Treatment Components Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.22)
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 Inspection	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, 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 Inspection	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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
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 Davis-Besse (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

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, piping elements, tanks, and fuel storage racks exposed to treated borated water > 140 °F (> 60 °C) (3.3.1-90)	Cracking due to SCC	Water Chemistry	No	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Sections 3.3.2.1.23 and 3.3.2.2.4)
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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.3.2.1.24)
Galvanized steel piping, piping components, and piping elements exposed to air-indoor uncontrolled (3.3.1-92)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
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	Not applicable	None	Consistent with 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	Not applicable	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 and aluminum piping, piping components, and piping elements exposed to air-indoor controlled (external) (3.3.1-95)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (see SER Section 3.3.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	Not applicable	None	Consistent with GALL Report (see SER Section 3.3.2.1.25)
Steel, stainless steel, aluminum, and copper-alloy piping, piping components, and piping elements exposed to gas (3.3.1-97)	None	None	Not applicable	None	Consistent with GALL Report
Steel, stainless steel, and copper-alloy piping, piping components, and piping elements exposed to dried air (3.3.1-98)	None	None	Not applicable	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 (3.3.1-99)	None	None	Not applicable	None	Consistent with 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 that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.3.2.2, discusses the staff's review of AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER

Section 3.3.2.3, discusses the staff's review of AMR results for components that the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the auxiliary systems components is documented in SER Section 3.0.3.

As a result of Revision 2 to the SRP-LR and the GALL Report, there was a significant realignment of AMR items as follows:

- In some cases, changes were of an administrative nature (e.g., an identical material, environment, aging effect, and recommended program in Table 3.3-1of the SRP-LR was renumbered with no other changes).
- Technical changes were implemented for specific Table 3.3-1 items (e.g., component information clarified, changes to environment, added concrete attributes evaluation, clarified BWR and PWR applicability).
- Many SRP-LR further evaluation recommendations were eliminated, principally because Revision 2 implemented changes to GALL Report AMPs and AMR items resulting in the further evaluation being addressed. As an example, Revision 1 of the SRP-LR and GALL Report recommended a further evaluation of a plant-specific program to manage hardening and loss of strength of elastomeric components exposed to air-indoor uncontrolled. Revision 2 of the SRP-LR and GALL Report incorporated elastomeric components, including visual exams and manipulation of the material into GALL Report AMPs XI.M36, "External Surfaces Monitoring of Mechanical Components" and XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," thus eliminating the need for a plant-specific program.
- Revision 2 contains additional material, environment, and aging effect combinations, thus eliminating the need for citing generic notes F–J given that the applicant could now select a Table 3.3-1 that is consistent. For example, AMR item 3.4-53, which addresses copper-alloy (less than or equal to 15 percent Zn and less than or equal to 8 percent Al) piping, piping components, and piping elements exposed to air with borated water leakage, was added.

In each instance, regardless of the type of change, the staff evaluated the Revision 1 technical requirements compared to the Revision 2 technical requirements and ensured that the applicant's LRA was evaluated against the current staff position as contained in Revision 2.

3.3.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Aboveground Steel Tanks Inspection Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Buried Piping and Tanks Inspection Program
- Closed Cooling Water Chemistry Program
- Collection, Drainage, and Treatment Components Inspection Program
- External Surfaces Monitoring Program
- Fire Water Program
- Flow-Accelerated Corrosion Program

- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water Program
- PWR Water Chemistry Program
- Selective Leaching Inspection Program

LRA Tables 3.3.2-1 through 3.3.2-32 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 claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine if the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A–E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these AMR items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to 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 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 AMR items to verify consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to verify consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. 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 item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these AMR items to 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 did the following:

- provided a brief description of the system, components, materials, and environments
- stated that the applicable aging effects were reviewed and evaluated in the GALL Report
- 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 determined 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 AMR Results Identified as Not Applicable

For items 3.3.1-36 and 3.3.1-38 in LRA Table 3.3.1, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR, confirmed these items only apply to BWRs, and finds these items are not applicable to Davis-Besse.

For items 3.3.1-62, 3.3.1-64, 3.3.1-67, 3.3.1-86, and 3.3.1-95 in LRA Table 3.3.1, the applicant claimed that they were not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Davis-Besse. The staff reviewed the LRA and USAR and confirmed that the applicant's LRA does not have any AMR results that are applicable to these items.

For LRA Table 3.3.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable; however, the staff non-applicability verification of these items required the review of sources beyond the LRA and FSAR, and/or the issuance of RAIs.

LRA Table 3.3.1, item 3.3.1-39, addresses stainless steel spent fuel storage racks exposed to treated water, which states that this item is not applicable because the applicability of the item is limited to BWRs. The GALL Report recommends using GALL Report AMP XI.M2, "Water Chemistry," to manage cracking due to SCC for this component group. The staff noted that cracking due to SCC is applicable for stainless steel components exposed to treated borated water higher than 60 °C (140 °F) as addressed in GALL Report, Revision 2, item VII.A2.A-97. Therefore, it was not clear why cracking due to SCC is not an AERM for the stainless steel spent fuel storage racks addressed in LRA Table 3.5.2-2. By letter dated May 2, 2011, the staff issued RAI 3.3.1.39-1 requesting the applicant justify why the cracking due to SCC is not an aging AERM for the stainless steel spent fuel storage racks. In addition, the staff asked the applicant to provide additional information on how this aging mechanism will be managed during the period of extended operation if it is determined that the spent fuel storage racks are susceptible to SCC under their exposure conditions.

In its response dated June 3, 2011, the applicant stated that cracking due to SCC or IGA is not an AERM of the stainless steel spent fuel storage racks exposed to treated water because the SFP water temperature is below the 140 °F threshold for SCC during normal operation. The applicant clarified that the SFP cooling system is designed to maintain the borated SFP water below 125 °F, and, in case of a partial core discharge, the SFP temperature is maintained below 133 °F during maximum normal heat load conditions. The applicant confirmed that its plant-specific operating experience has not indicated instances of cracking due to SCC on the spent fuel storage racks. Even though cracking is not an applicable aging effect for the stainless steel spent fuel storage racks, the applicant stated the treated borated water in contact with this component is managed by the PWR Water Chemistry Program.

Based on its review, the staff finds that the applicant's determination that LRA Table 3.3.1, item 3.3.1-39, is not applicable, and the applicant's response acceptable for the following reasons:

- Under normal operations, the spent fuel temperature is maintained below the threshold temperature of 60 °C (140 °F), as addressed in GALL Report, Revision 2, Table IX.D.
- The treated borated water in contact with these components is managed by the PWR Water Chemistry Program.
- The applicant confirmed that the plant-specific operating experience has not indicated instances of cracking due to SCC of these components.

The staff's concern described in RAI 3.3.1.39-1 is resolved.

LRA Table 3.3.1, item 3.3.1-49, addresses stainless steel or steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the Closed-Cycle Cooling Water System Program to manage loss of material due to MIC for this component group. The applicant stated that this item is not applicable because loss of material due to MIC is not identified as an AERM for stainless steel heat exchanger components that are exposed to closed-cycle cooling water. The staff evaluated the applicant's claim and noted that it is not clear to the staff why the applicant does not consider loss of material due to MIC to be an applicable aging affect for stainless steel exposed to closed-cycle cooling water. By letter dated May 2, 2011, the staff issued RAI 3.3.1.49-1 requesting that the applicant state the basis for not managing stainless steel components exposed to closed-cycle cooling water for loss of material due to MIC.

In its response dated June 3, 2011, the applicant stated that, because Davis-Besse has no plant-specific operating experience of MIC in its closed-cycle cooling water environments, MIC is not an AERM.

The staff found the applicant's response unacceptable because the EPRI closed cooling water chemistry guidelines state that MIC is a significant issue in closed cooling water systems. The EPRI report also states that stagnant loops in closed cooling water system can accumulate microorganisms, and their nutrients and water chemistry in these areas are difficult to maintain. The staff guidance in SRP-LR Section A.1.2.1 states that an aging effect should be identified as applicable for license renewal even if there is a prevention or mitigation program associated with that aging effect. By letter dated July 12, 2011, the staff issued RAI 3.3.1.49-2 requesting that the applicant include monitoring for MIC in the Closed Cooling Water Chemistry Program to ensure that the control of water chemistry remains fully effective at preventing this aging mechanism or provide technical justification for why MIC is not credible at Davis-Besse, regardless of water chemistry controls.

In its response dated August 17, 2011, the applicant stated that the Closed Cooling Water Chemistry Program monitors specific parameters to assure that corrosion is minimized, microbial activity is suppressed, and corrosion inhibitor stability is maintained. The applicant revised the program description in LRA Section B.2.8 and the USAR supplement in LRA Section A.1.8 to state that the Closed Cooling Water Chemistry Program will monitor for microbiological activity in accordance with the EPRI closed-cycle cooling water guidelines. The applicant also revised LRA Table 3.3.1, item 3.3.1-49, to state that this item is applicable and that MIC is monitored by the Closed Cooling Water Chemistry Program.

The staff finds the applicant's response acceptable because the applicant will manage loss of material due to MIC with the Closed Cooling Water Program, which includes water chemistry controls and inspections that can mitigate and detect corrosion prior to loss of intended function. The staff's concerns described in RAI 3.3.1.49-1 and 3.3.1.49-2 are resolved.

The applicant also stated that this item is not applicable to steel with stainless steel cladding heat exchanger components because there are no steel with stainless steel cladding heat exchanger components that are exposed to closed-cycle cooling water and subject to an AMR. The staff reviewed LRA Sections 2.3.3 and 3.3 and the USAR and confirmed that no in-scope steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water are present in the auxiliary systems; therefore, it finds the applicant's claim acceptable.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.3.1-49, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material due to MIC, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function.

LRA Table 3.3.1, items 3.3.1-65 and 3.3.1-66, address reinforced concrete structural fire barriers, walls, ceilings, and floors exposed to air-indoor (uncontrolled) or air-outdoor, which are being managed for concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates. LRA Table 3.3.1, item 3.3.1-67, addresses reinforced concrete structural fire barriers, walls, ceilings, and floors exposed to air-indoor (uncontrolled) and air-outdoor, which are being managed for loss of material due to corrosion of embedded steel. The GALL Report recommends both the Fire Protection and Structures Monitoring Programs to manage concrete cracking and spalling and loss of material for these component groups. The applicant stated that LRA Table 3.3.1, items 3.3.1-65 and 3.3.1-66, are not applicable because concrete cracking and spalling were not identified as applicable aging effects for concrete structural fire barriers. The applicant also stated that LRA Table 3.3.1, item 3.3.1-67, is not applicable because it is being managed by LRA Table 3.5.1, item 3.5.1-23. The staff reviewed all of the AMR items for concrete structural fire barriers in the LRA and noted that, in some instances, the applicant cited no aging effects for concrete structural fire barriers but credited both the Structures Monitoring and Fire Protection Programs to confirm the absence of aging effects. The staff also noted that in the remaining AMR items for concrete structural fire barriers, the applicant cited alternative items from LRA Table 3.5.1, including items 3.5.1-23, 3.5.1-24, 3.5.1-26, and 3.5.1-32, to manage loss of material, cracking, and change in material properties, and it credited both the Structures Monitoring and Fire Protection Programs to manage the aging effects. The staff further noted that, while some AMR items do not have an aging effect listed, the inspections performed by the Structures Monitoring and Fire Protection Programs will detect the GALL Report recommended aging effects of concrete cracking and spalling and loss of material. The staff evaluated the applicant's claim that these items are not applicable and finds it acceptable because the applicant is managing aging for concrete structural fire barriers using both the Structures Monitoring and Fire Protection Programs, which is consistent with the GALL Report recommendations. LRA Table 3.3.1, item 3.3.1-55, addresses steel ducting closure bolting exposed to air-indoor uncontrolled (external). The GALL Report recommends the External Surfaces Monitoring Program to manage loss of material due to general corrosion for this component group. The applicant stated that this item is not applicable because the AERM for this component group is being managed under LRA Table 3.3.1, item 3.3.1-43. The staff noted that LRA Table 3.3.1, item 3.3.1-43, addresses steel bolting and closure bolting exposed to air-indoor uncontrolled (external), or air-outdoor (external), which are being managed for loss of material due to general, pitting, and crevice corrosion by the Bolting Integrity Program. The staff evaluated the applicant's claim and found it acceptable because the material environment and aging effect combination that would be managed for this component group by item 3.3.1-55 is encompassed by the material environment and aging effect being managed by item 3.3.1-43, and the applicant's Bolting Integrity Program includes periodic visual inspections of bolting, which are capable of detecting loss of material prior to loss of intended function.

LRA Table 3.3.1, item 3.3.1-74, addresses steel crane-rails exposed to air-indoor uncontrolled (external). The GALL Report recommends the Inspection of overhead heavy load and light load (related to refueling) handling systems program to manage loss of material due to wear for this component group. The applicant stated that this item is not applicable because loss of material due to wear is not identified as an AERM for carbon steel crane bridges, trolleys, rails, and girders that are exposed to air-indoor uncontrolled (external). The staff evaluated the applicant's claim and noted that the applicant did not provide sufficient justification to explain why the loss of material due to wear would not be an applicable AERM for these components. By letter dated May 2, 2011, the staff issued RAI 3.3.1.74-1 requesting that the applicant justify its use of this material, environment, aging effect and program combination.

In its response dated June 3, 2011, the applicant stated that crane rail loss of material due to wear is managed by the Cranes and Hoists Inspection Program using visual inspections consistent with the GALL Report. The applicant revised LRA Table 3.3.1, item 3.3.1-74, to address loss of material due to wear. Table 3.3.1, item 3.3.1-74, is no longer identified as a not applicable item. The applicant also added new rows to LRA Tables 3.5.2-1, 3.5.2-2, and 3.5.2-3 for loss of material due to wear for crane rails, aligned to LRA Table 3.3.1, item 3.3.1-74, as generic note A items consistent with the GALL Report. The staff finds the applicant's response acceptable because the applicant will manage loss of material due to wear and has revised the LRA accordingly to reflect the addition of the aging effect for crane rails. The staff's concern described in RAI 3.3.1.74-1 is resolved.

LRA Table 3.3.1, item 3.3.1-80, 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 Program to manage loss of material due to pitting, crevice, and MIC for this component group. The applicant stated that this item is not applicable because it has referred these types of aging effects to either LRA item 3.3.1-78 or 3.3.1-79. The staff evaluated the applicant's claim and noted that neither of the LRA item 3.3.1-78 or 3.3.1-79 manages aging of stainless steel and copper-alloys components exposed to raw water for loss of material due to MIC. It is not clear to the staff if the applicant is managing MIC of these components in auxiliary systems. By letter dated May 2, 2011, the staff issued RAI 3.3.1.80-1 requesting that the applicant clarify whether the stainless steel and copper-alloy piping, piping components, and piping elements exposed to raw water are being managed for loss of material due to MIC. If not, the staff asked the applicant to provide justification.

In its response dated June 3, 2011, the applicant stated that the stainless steel and copper-alloy piping, piping components, and piping elements exposed to raw water are managed for loss of material due to MIC. The applicant further stated that components aligned to LRA Table 3.3.1, items 3.3.1-78 and 3.3.1-79, are managed by the Collection, Draining, and Treatment Components Inspection Program and the Open-Cycle Cooling Water Program. The applicant stated that the Open-Cycle Cooling Water Program manages loss of material due to MIC. The applicant stated that the Collection, Draining, and Treatment Components Inspection Program manages loss of material regardless of the mechanism. That applicant further stated that both programs consist of inspections and surveillances to detect and evaluate loss of material. The applicant also stated that the Open-Cycle Cooling Water Program includes chemical treatments and cleaning activities to minimize loss of material. The staff finds the applicant's response acceptable because it clarifies that the applicant will be managing loss of material due to MIC in addition to other relevant mechanisms. The staff finds the applicant's determination that item 3.3.1-80 is not applicable acceptable. The staff's concern described in RAI 3.3.1.80-1 is resolved.

LRA Table 3.3.1, item 3.3.1-87, addresses Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water. The applicant stated that this item is not applicable because there are no Boraflex spent fuel storage racks neutron-absorbing sheets that are exposed to treated borated water and subject to an AMR. Furthermore, the applicant stated that the Davis-Besse SFP rack neutron absorbers are fabricated of Boral®. The staff reviewed the USAR to verify that there are no Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water. Based on information in the USAR, the staff confirmed that the applicant's plant does not have Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water. Therefore, the staff finds the applicant's determination that item 3.3.1-87 is not applicable acceptable.

LRA Table 3.3.1, item 3.3.1-92, addresses galvanized steel piping, piping components, and piping elements exposed to uncontrolled indoor air and states that there are no aging effects, aging mechanisms, or AMPs. The GALL Report, Table VII, item VII.J-6 (AP-13), recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group exposed to this environment. The applicant stated that this item is not applicable because no credit is taken for coatings; therefore, the material is evaluated as steel. The staff noted that in place of item 3.3.1-92, the applicant applied LRA Table 3.3.1, items 3.3.1-57 and 3.3.1-58, which address the external surfaces of steel piping and components exposed to uncontrolled indoor air, outdoor air, and condensation, which are managed for loss of material due to general corrosion by the External Surfaces Monitoring Program. The staff evaluated the applicant's claim and found it acceptable because the applicant's decision to not credit coatings for the prevention of aging is a reasonable approach to ensure that loss of material due to general corrosion will be adequately managed during the period of extended operation.

3.3.2.1.2 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-37, addresses stainless steel piping, piping components, and piping elements exposed to treated water greater than 140 °F (60 °C) (internal), which are being managed for cracking due to SCC and IGSCC. The LRA also states that this item is also applied to stainless steel tanks exposed to treated water greater than 140 °F (greater than 60 °C). For the AMR items that cite generic note E, the LRA credits the One-Time Inspection and PWR Water Chemistry Programs to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M25, "BWR Reactor Water Cleanup System," to manage the aging effect.

GALL Report AMP XI.M25 recommends ISIs and monitoring and control of reactor coolant water chemistry to manage cracking. In its review of components associated with item 3.3.1-37, for which the applicant cited generic note E, the staff noted that the One-Time Inspection and PWR Water Chemistry Programs propose to manage the aging of stainless steel piping, strainers, tanks, and valve bodies through the periodic sampling of treated water and one-time inspections of selected stainless steel components to confirm that cracking is not occurring.

The staff's evaluations of the applicant's One-Time Inspection and PWR Water Chemistry Programs are documented in SER Sections 3.0.3.2.11 and 3.0.3.1.15, respectively. The staff noted that the applicant's One-Time Inspection Program includes the following:

- determination of a representative sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience
- identification of locations where components are most susceptible to cracking
- examination techniques such as volumetric or surface examinations
- acceptance criteria for cracking
- expansion of inspection locations if cracking is discovered

The staff also noted that the PWR Water Chemistry Program will maintain contaminants within acceptable limits to preclude cracking in components exposed to treated water greater than 140 °F (60 °C) (internal). In its review of components associated with item 3.3.1-37, the staff finds the applicant's proposal to manage aging using the One-Time Inspection and PWR Water Chemistry Programs acceptable because maintaining contaminants within acceptable limits minimizes the likelihood of cracking, and the one-time inspection can detect whether cracking is occurring.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.3 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-46, addresses stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water greater than 140 °F (60 °C), which are being managed for cracking due to SCC. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System" to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, the GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.3.1-46, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of stainless steel piping, piping components, piping elements, and heat exchanger components through chemistry controls consistent with current EPRI water chemistry guidelines and periodic inspections, on a 10-year interval, to ensure that material degradation is not occurring.

The applicant stated that for item 3.3.1-46, the applicability is limited to stainless steel piping and heat exchanger components exposed to closed-cycle cooling water greater than 140 °F (60 °C). The staff noted that a search of the applicant's USAR confirmed that no in-scope stainless clad steel piping and heat exchanger components exposed to closed-cycle cooling water greater than 140 °F (60 °C) are present in the auxiliary systems.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.3.1-46, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on SCC, and the periodic inspections can detect the presence or extent of cracking prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.4 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-47, addresses steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed-cycle cooling water, which are being managed for loss of material due to general, pitting, and crevice corrosion. The staff noted that the applicant addressed steel heat exchanger components in item 3.3.1-48, which includes an additional aging mechanism of galvanic corrosion. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.3.1-47, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of steel piping, piping components, piping elements, and tanks through chemistry controls consistent with current EPRI water chemistry guidelines, periodic inspections on a 10-year interval, and corrosion rate measurements via corrosion coupons to ensure that material degradation is not occurring.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.3.1-47, the staff finds the applicant’s proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.5 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.3.1, item 3.3.1-48, addresses steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed-cycle cooling water, which are being managed for loss of material due to general, pitting, crevice, and galvanic corrosion. The staff noted that the applicant applied item 3.3.1-47 to steel piping, piping components, piping elements, and tanks, which does not include the aging mechanism of galvanic corrosion. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, “Closed-Cycle Cooling Water System,” to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.3.1-48, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of steel heat exchanger components through chemistry controls consistent with current EPRI water chemistry guidelines and periodic inspections, on a 10-year interval, to ensure that fouling is not occurring.

The staff noted that the applicant cited LRA Table 3.3.1, item 3.3.1-48, for loss of material due to general, pitting, crevice, and galvanic corrosion for the gray cast iron heat exchanger shell in the startup feed pump (SUFP) lube oil cooler (DB-E30) exposed to closed-cycle cooling water. The staff also noted that the applicant does not credit the Selective Leaching Program to manage loss of material due to selective leaching for the same component. GALL Report, Volume 1, Table 3, item 85, recommends that gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water be managed by the Selective Leaching of Materials Program for loss of material due to selective leaching. By letter dated May 2, 2011, the staff issued RAI 3.3.1.85-1 requesting that the applicant state why loss of material due to selective leaching is not an applicable aging effect for the gray cast iron heat exchanger shell in the SUFP lube oil cooler (DB-E30).

In its response dated June 3, 2011, the applicant stated that the gray cast iron heat exchanger shell in the SUFP lube oil cooler (DB-E30) exposed to closed cycle cooling water in the turbine plant cooling water system is susceptible to selective leaching. The applicant further stated that the selective leaching will be managed by the Selective Leaching Inspection Program. The applicant stated that LRA Table 3.3.2-32 is revised to add a new row to identify the need to manage selective leaching for the gray cast iron heat exchanger shell in the SUFP lube oil cooler. The staff finds the applicant’s response acceptable because the applicant modified the LRA to include selective leaching as an applicable aging effect for the gray cast iron heat exchanger shell. Additionally, the visual inspections, hardness measurements, and other mechanical manipulations in the Selective Leaching Inspection Program are capable of detecting material degradation prior to loss of intended function. The staffs concern described in RAI 3.3.1.85-1 is resolved.

The staff's evaluations of the applicant's Closed Cooling Water System and Selective Leaching Inspection Programs are documented in SER Sections 3.0.3.2.4 and 3.0.3.1.16, respectively. In its review of components associated with item 3.3.1-48, the staff finds the applicant's proposal to manage loss of material due to general, pitting, crevice, and galvanic corrosion using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report. The staff also finds the applicant's proposal to manage loss of material due to selective leaching by the Selective Leaching Inspection Program acceptable, as stated in the discussion of RAI 3.3.1.85-1 above.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.6 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-50, addresses stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water, which are being managed for loss of material due to pitting and crevice corrosion. The staff noted that the applicant also applied this item to stainless steel heat exchanger components and compressor casings exposed to closed-cycle cooling water. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.3.1-50, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of stainless steel piping, piping components, piping elements, heat exchanger components, and compressor casings through chemistry controls consistent with current EPRI water chemistry guidelines, periodic inspections on a 10-year interval, and corrosion rate measurements via corrosion coupons to ensure that material degradation is not occurring.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.3.1-50, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.7 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.3.1, item 3.3.1-51, addresses copper-alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water, which are being managed for loss of material due to pitting, crevice, and galvanic corrosion. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.3.1-51, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of copper-alloy piping, piping components, piping elements, and heat exchanger components through chemistry controls consistent with current EPRI water chemistry guidelines, periodic inspections on a 10-year interval, and corrosion rate measurements via corrosion coupons to ensure that material degradation is not occurring.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.3.1-51, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on loss of material, and the periodic inspections and corrosion rate measurements can detect the presence or extent of corrosion prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.8 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3.1, item 3.3.1-52, addresses steel, stainless steel, and copper-alloy heat exchanger tubes exposed to closed-cycle cooling water, which are being managed for reduction of heat transfer due to fouling. The LRA credits the Closed Cooling Water Chemistry Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M21, "Closed-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

For these items, GALL Report AMP XI.M21 recommends using water chemistry controls in accordance with the EPRI closed cooling water chemistry guidelines. In addition, GALL Report AMP XI.M21 recommends performance monitoring techniques for pumps and heat exchangers to manage the aging of this item. In its review of components associated with item 3.3.1-52, the staff noted that the Closed Cooling Water System Program proposes to manage the aging of steel, stainless steel, and copper-alloy heat exchanger tubes through chemistry controls consistent with current EPRI water chemistry guidelines and periodic inspections, on a 10-year interval, to ensure that fouling is not occurring.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. In its review of components associated with item 3.3.1-52, the staff finds the applicant's proposal to manage aging using the Closed Cooling Water System

Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on reduction of heat transfer due to fouling, and the periodic inspections can detect the presence or extent of fouling prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.9 Loss of Material Due to General and Pitting Corrosion

LRA Table 3.3.1, item 3.3.1-53, addresses steel compressed air system piping, piping components, and piping elements exposed to condensation, which are being managed for loss of material due to general and pitting corrosion. For the AMR items that cite generic note E, the LRA credits the One-Time Inspection Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M24, “Compressed Air Monitoring,” to ensure that these aging effects are adequately managed.

For those items associated with generic note E, GALL Report AMP XI.M24 recommends controlling moisture and other corrosive contaminants below acceptable limits to mitigate the loss of material due to corrosion. It also recommends periodic air samples be analyzed for moisture and other corrosives and periodic and opportunistic inspections be performed of accessible surfaces. In its review of components associated with item 3.3.1-53, for which the applicant cited generic note E, the staff noted that the One-Time Inspection Program proposes to manage the aging of steel compressed air system piping, piping components, and piping elements exposed to condensation through the use of one-time inspection for parameters directly related to the degradation of the metallic components, including visual evidence of corrosion or fouling. By letter dated April 20, 2011, the staff issued RAI 3.3.2.71-2 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects in lieu of a program with periodic inspections.

In its response dated May 24, 2011, the applicant stated that this aging effect will be managed by the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. In addition, the applicant stated that the visual inspections will be capable of managing loss of material through the period of extended operation, consistent with the GALL Report. The staff’s evaluation of the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant’s response, and its proposal to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material for these components, acceptable because the program includes visual periodic opportunistic inspections conducted by qualified personnel, which are capable of detecting loss of material prior to loss of component intended function. The staff’s concern described in RAI 3.3.2.71-2 is resolved.

By letter dated April 20, 2011, the staff issued RAI Sampling 1.0 requesting the applicant to verify many components’ material composition and AMR based on the results of walkdowns conducted during the onsite audit. In its response dated May 24, 2011, the applicant revised the material designation of an item in Table 3.3.2-29, row 7, which cited item 3.3.1-53 from steel to plastic (polymer). LRA Table 3.3.2-29, row 7, has now been evaluated as having no AERM and, thereby, no AMP assigned. This item now cites generic note F. The staff reviewed the associated item in the LRA and confirmed that no credible aging effects are applicable for this component (filter housing), material (polymer), and environmental combination (condensation)based on its review of the GALL Report, which includes these types of polymer components in the environments of air-indoor, uncontrolled, and condensation and states the aging effect/mechanism and AMP are none.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain 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 Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-54, addresses stainless compressed air system piping, piping components, and piping elements exposed to internal condensation, which are being managed for loss of material due to pitting and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage aging for filter housings, orifices, piping, pump casings, tanks, tubing, moisture separators, trap bodies, and valve bodies in the gaseous radwaste system. Additionally, the LRA credits the One-Time Inspection Program to manage aging for tubing in the instrument air system. The GALL Report recommends GALL Report AMP XI.M24 "Compressed Air Monitoring," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M24 recommends periodic visual inspections, leakage testing, and air quality monitoring to manage loss of material. In its review of components associated with item 3.3.1-54, for which the applicant cited generic note E, the staff noted that the One-Time Inspection Program does not include periodic inspections, and the Collection, Drainage, and Treatment Components Inspection Program does not include any preventive measures, such as air quality testing, as recommended by the GALL Report. However, the staff also noted that item 3.3.1-54 is for components in the instrument air system; therefore, the condensation would be from moisture in the air source for the compressed air system, which could contain contaminants, such as halides, that could cause aging. The staff further noted that the GALL Report has other AMR items for stainless steel components exposed to condensation in the ECCS (V.D2-35) and control room ventilation system (VII.F1-1), which recommend evaluation of a plant-specific program to manage loss of material.

The staff's evaluation of the applicant's Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that this program includes opportunistic visual inspections and focused inspections if opportunistic inspections are not performed. The staff finds the applicant's proposal to manage loss of material for stainless steel components exposed to condensation in the gaseous radwaste system using the Collection, Drainage, and Treatment Components Inspection Program acceptable because the condensation is from exposure to station radioactive waste, and the program includes visual inspections, which are capable of detecting loss of material.

The LRA credits the One-Time Inspection Program to manage aging for stainless steel tubing in the instrument air system. It is not clear to the staff how the applicant's One-Time Inspection Program, which does not include periodic inspections or preventive measures, is adequate to manage loss of material for stainless steel components exposed to internal condensation in the instrument air system, given that the GALL Report recommends periodic inspections, leakage testing, and air quality monitoring to manage the aging effect. By letter dated May 2, 2011, the staff issued RAI 3.3.1.54-1 requesting that the applicant explain why a one-time inspection is an acceptable alternative to periodic inspections and air quality monitoring to manage loss of material for these components.

In its response dated June 3, 2011, the applicant stated that the AMP for managing loss of material for stainless steel tubing exposed to internal condensation was changed from the One-Time Inspection Program to the Inspection of internal Surfaces in Miscellaneous Piping and Ducting Program in its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff's evaluation of the applicant's Inspection of internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response, and its proposal to manage loss of material for stainless steel tubing using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because the program includes opportunistic visual inspections that are capable of detecting loss of material. The staff's concern described in RAI 3.3.1.54-1 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.11 Hardening and Loss of Strength

LRA Table 3.3.1, item 3.3.1-61, addresses elastomer fire barrier penetration seals exposed to air-outdoor or air-indoor uncontrolled, which are being managed for hardening and loss of strength due to weathering. For the AMR items in LRA Tables 3.3.2-12 and 3.3.2-30 associated with generic note E, the LRA, as amended by letter dated May 24, 2011, credits the External Surface Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Programs to manage the aging effects for elastomer flexible connections. The GALL Report recommends GALL Report AMP XI.M26, "Fire Protection," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M26 recommends using visual examinations to manage hardening and loss of strength for elastomer fire barrier penetration seals. In its review of the components associated with LRA item 3.3.1-61, for which the applicant cited generic note E, the staff noted that the External Surface Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Programs propose to manage the aging of the elastomer flexible connections through the use of visual inspections and physical examinations.

The staff's evaluation of the applicant's External Surface Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Programs are documented in SER Sections 3.0.3.2.5 and 3.0.3.3.7. In its review of components associated with item 3.3.1-61, the staff finds the applicants proposal to manage aging using the External Surface Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Programs acceptable because the programs include periodic visual examinations and physical inspections (such as manipulation and prodding) of components, which are capable of detecting these aging effects prior to loss of component intended function.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.12 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3.1, item 3.3.1-68, addresses steel piping, piping components, and piping elements exposed to raw water, which are being managed for loss of material due to general, pitting, crevice, and MIC and fouling. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage the aging effects for steel and gray cast iron piping, filter bodies, tubing, and valve bodies. The GALL Report recommends GALL Report AMP XI.M27, “Fire Water System,” to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M27 recommends using multiple inspection methods, including flow testing and wall thickness evaluations performed using non-intrusive testing or periodic internal visual inspections, to manage loss of material. GALL Report AMP XI.M27 also recommends that the visual inspections be performed on a representative number of locations on a reasonable basis and be capable of evaluation (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the pipe as it applies to the design flow. In its review of components associated with item 3.3.1-68, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage aging using visual inspections. The visual inspections in the Collection, Drainage, and Treatment Components Inspection Program are not required to be performed on a representative number of locations on a reasonable basis and do not state that they are capable of detecting wall thickness to ensure against catastrophic failure or the inner diameter of the pipe as it applies to design flow. It is not clear to the staff how the Collection, Drainage, and Treatment Components Inspection Program will be adequate to manage loss of material due to general, pitting, crevice, and MIC and fouling, given that the program only includes visual inspections. By letter dated May 2, 2011, the staff issued RAI 3.3.1.68-1 requesting that the applicant justify the use of the Collection, Drainage, and Treatment Components Inspection Program rather than the Fire Water System Program to manage loss of material for steel and gray cast iron components exposed to raw water.

In its response dated June 3, 2011, the applicant stated that the steel components exposed to raw water, which are being managed by the Collection, Drainage, and Treatment Components Inspection Program, are associated with the cooling circuit for the fire protection diesel engine and are not within the scope of the Fire Water Program. The applicant stated that the reason these components are not within the scope of the Fire Water Program is because the Fire Water Program only applies to the fire water supply and water-based suppression systems, consistent with NFPA-25, “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.” The applicant also stated that the gray cast iron component being managed by the Collection, Drainage, and Treatment Components Inspection Program, which cites generic note E and item 3.3.1-68, is associated with sump pump discharge piping in the station plumbing, drains, and sumps system and is not within the scope of the Fire Water Program. The staff confirmed that the subject components are not within the scope of the Fire Water Program. The staff finds the applicant’s response, and its proposal to manage aging using the Collection, Drainage, and Treatment Components Inspection Program, acceptable because the components are not within the scope of the Fire Water Program and the Collection, Drainage, and Treatment Components Inspection Program includes visual inspections, which are capable of detecting loss of material prior to loss of intended function. The staff’s concern described in RAI 3.3.1.68-1 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain 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 and Crevice Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-69, addresses stainless steel components exposed to raw water, which are being managed for loss of material due to pitting and crevice corrosion and fouling. For the AMR items that cite generic note E, the LRA credits the Collection Drainage, and Treatment Components Inspection Program to manage loss of material for stainless steel flexible connections exposed to raw water. The GALL Report recommends GALL Report AMP XI.M27, “Fire Water System,” to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M27 recommends using multiple inspection methods, including flow testing and wall thickness evaluations performed using non-intrusive testing or periodic internal visual inspections, to manage loss of material. GALL Report AMP XI.M27 also recommends that the visual inspections be performed on a representative number of locations on a reasonable basis and be capable of evaluating (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the pipe as it applies to the design flow. In its review of components associated with item 3.3.1-69, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage aging of stainless steel flexible connections using opportunistic visual inspections. The visual inspections in the Collection, Drainage, and Treatment Components Inspection Program are not required to be performed on a representative number of locations on a reasonable basis and do not state that they are capable of detecting wall thickness to ensure against catastrophic failure or the inner diameter of the pipe as it applies to design flow. It is not clear to the staff how the Collection, Drainage, and Treatment Components Inspection Program will be adequate to manage loss of material due to pitting, crevice corrosion, and fouling, given that the program only includes opportunistic visual inspections. By letter dated May 2, 2011, the staff issued RAI 3.3.1.68-1 requesting that the applicant justify the use of the Collection, Drainage, and Treatment Components Inspection Program rather than the Fire Water System Program to manage loss of material for stainless steel components exposed to raw water.

In its response dated June 3, 2011, the applicant stated that the stainless steel components exposed to raw water, which are being managed by the Collection, Drainage, and Treatment Components Inspection Program, are associated with the cooling circuit for the fire protection diesel engine and are not within the scope of the Fire Water Program because the Fire Water Program only applies to the fire water supply and water-based suppression systems. The applicant also stated that the recommendations in NFPA-25 associated with the diesel fire pump cooling circuit do not address the condition of components in the cooling circuit but rather on supporting functionality of the diesel fire pump. The staff noted that GALL Report AMP XI.M27 includes recommendations for periodic flushing, flow testing, and inspections of the water-based fire protection system piping, including sprinkler systems, but does not include recommendations for testing the functionality of the diesel fire pump. The staff finds the applicant’s response, and its proposal to manage aging using the Collection, Drainage, and Treatment Components Inspection Program, acceptable because the components are not within the scope of the Fire Water Program. Additionally, the Collection, Drainage, and Treatment Components Inspection Program includes visual inspections, which are capable of detecting loss of material prior to loss of intended function. The staff’s concern described in RAI 3.3.1.68-1 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.14 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3.1, item 3.3.1-70, addresses copper-alloy piping, piping components, and piping elements exposed to raw water, which are being managed for loss of material due to pitting, crevice, and MIC and fouling. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage loss of material for heat exchangers components (gear housing oil cooler and radiator) and valve bodies made of copper alloy with greater than 15 percent Zn. The GALL Report recommends GALL Report AMP XI.M27, "Fire Water System," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M27 recommends using multiple inspection methods, including flow testing and wall thickness evaluations performed using non-intrusive testing or internal visual inspections, to manage loss of material. GALL Report AMP XI.M27 also recommends that the visual inspections be performed on a representative number of locations on a reasonable basis and be capable of detecting wall thickness to ensure against catastrophic failure and the inner diameter of the pipe as it applies to design flow. In its review of components associated with item 3.3.1-70, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage loss of material using opportunistic visual inspections. The visual inspections in the Collection, Drainage, and Treatment Components Inspection Program are not required to be performed on a representative number of locations on a reasonable basis and do not state that they are capable of detecting wall thickness to ensure against catastrophic failure or the inner diameter of the pipe as it applies to design flow. It is not clear to the staff how the Collection, Drainage, and Treatment Components Inspection Program will be adequate to manage loss of material due to pitting, crevice, and MIC and fouling, given that the program only includes opportunistic visual inspections. By letter dated May 2, 2011, the staff issued RAI 3.3.1.68-1 requesting the applicant justify the use of the Collection, Drainage, and Treatment Components Inspection Program, rather than the Fire Water System Program, to manage loss of material for copper-alloy components exposed to raw water.

In its response dated June 3, 2011, the applicant stated that the copper-alloy components exposed to raw water, which are being managed by the Collection, Drainage, and Treatment Components Inspection Program, are associated with the cooling circuit for the fire protection diesel engine and are not within the scope of the Fire Water Program because the Fire Water Program only applies to the fire water supply and water-based suppression systems. The applicant also stated that the recommendations in NFPA-25 associated with the diesel fire pump cooling circuit do not address the condition of components in the cooling circuit but rather on supporting functionality of the diesel fire pump. The staff noted that GALL Report AMP XI.M27 includes recommendations for periodic flushing, flow testing, and inspections of the water-based fire protection system piping, including sprinkler systems, but does not include recommendations for testing the functionality of the diesel fire pump. The staff finds the applicant's response, and its proposal to manage aging using the Collection, Drainage, and Treatment Components Inspection Program, acceptable because the components are not within the scope of the Fire Water Program, and the Collection, Drainage, and Treatment Components Inspection Program includes visual inspections, which are capable of detecting loss of material prior to loss of intended function. The staff's concern described in RAI 3.3.1.68-1 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain 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, and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-71, addresses steel and gray cast iron piping and piping elements exposed to moist air (internal) and condensation (internal), which are being managed for loss of material due to general, pitting, and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the One-Time Inspection Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to ensure that these aging effects are adequately managed.

For those items associated with generic note E, GALL Report AMP XI.M38 recommends using visual inspections performed by personnel qualified in accordance with site-controlled procedures and processes to manage aging. In its review of components associated with item 3.3.1-71, for which the applicant listed generic note E, the staff noted that the One-Time Inspection Program proposes to manage the aging of steel and gray cast iron piping, piping components, and piping elements through the use of a one-time inspection. The GALL Report states that one-time inspections are only appropriate when an aging effect is not expected or is expected to occur very slowly, neither of which are true to steel components exposed to moist air or condensation. By letter dated April 20, 2011, the staff issued RAI 3.3.2.71-2 requesting that the applicant provide details of a program to adequately manage these materials and environmental combinations.

In its response dated May 24, 2011, the applicant stated that aging of steel and gray cast iron piping, piping components, and piping elements exposed to air (including air-indoor uncontrolled and air-outdoor); condensation, diesel exhaust, or moist air; and external cooling coil surfaces will be managed by its new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also stated that the plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program will include opportunistic inspections when components are opened for maintenance, repair, or surveillance. In addition, the applicant stated that the visual inspections will be supplemented by NDE techniques, as appropriate, which will be capable of managing loss of material through the period of extended operation, consistent with the GALL Report. The applicant retained the One-Time Inspection Program to manage components at the air-water interface with periodic programs credited to manage aging above and below the interface. In an additional applicant response, dated September 16, 2011, concerning aging management of components with an air-water interface, the applicant revised the LRA to define that the moist air (internal) environment encompasses both the air-water interface and the air environment above the interface. The applicant also revised the LRA to combine the air-water interface AMR items with the AMR items for the air above the interface. The combined items credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material (except for selective leaching) and cracking for all in-scope components subject to a moist air environment.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response, and its proposal to manage aging for these components using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because the program includes visual opportunistic inspections conducted by qualified personnel that are capable of detecting loss of material prior to loss of component intended function. The staff's concern described above is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain 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 General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-72, addresses steel HVAC ducting and components exposed to condensation (internal), which are being managed for loss of material due to general, pitting, crevice, and MIC. For the AMR items that cite generic note E, the LRA credits the One-Time Inspection Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to ensure that these aging effects are adequately managed.

For those items associated with generic note E, GALL Report AMP XI.M38 recommends using visual inspections performed by personnel qualified in accordance with site controlled procedures and processes to manage the aging of these AMR items. In its review of components associated with item 3.3.1-72, for which the applicant listed generic note E, the staff noted that the One-Time Inspection Program proposes to manage the aging of steel HVAC ducting and components through the use of a one-time inspection. The GALL Report states that one-time inspections are only appropriate when an aging effect is not expected or is expected to occur very slowly, neither of which are true to steel components exposed to condensation. It is not clear to the staff why the applicant proposed to use its One-Time Inspection Program. By letter dated April 20, 2011, staff issued RAI 3.3.2.71-2 requesting that the applicant provide details of a program to adequately manage these material and environment combinations.

In its response dated May 24, 2011, the applicant stated that the aging of steel and gray cast iron piping, piping components, and piping elements exposed to air (including air-indoor uncontrolled and air-outdoor); condensation, diesel exhaust, or moist air; and external cooling coil surfaces will be managed by its new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also stated that the plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program will include opportunistic inspections when components are opened for maintenance, repair, or surveillance. In addition, the applicant stated that the visual inspections will be supplemented by NDE techniques, as appropriate, which will be capable of managing loss of material through the period of extended operation consistent with the GALL Report.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response, and its proposal to manage aging for these components using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because the program includes visual opportunistic inspections conducted by qualified personnel that are capable of detecting loss of material prior to loss of component intended function. The staff's concern described above is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.17 Hardening and Loss of Strength Due to Elastomer Degradation; Loss of Material Due to Erosion

LRA Table 3.3.1, item 3.3.1-75, addresses elastomer flexible connections exposed to raw water, which are being managed for hardening, loss of strength, and loss of material. For the AMR items that cite generic note E, the LRA credits the One-Time Inspection Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M20, “Open-Cycle Cooling Water System,” to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M20 recommends using periodic visual inspections in conjunction with water chemistry controls to manage the aging. In its review of components associated with item 3.3.1-75, for which the applicant cited generic note E, the staff noted that the One-Time Inspection Program proposes to manage the aging of elastomer flexible connections through the use of a one-time physical examination, such as manipulation and prodding. It is not clear to the staff how a one-time inspection will be adequate to detect hardening and loss of strength due to elastomer degradation and loss of material due to erosion of elastomer seals and components exposed to raw water. By letter dated May 2, 2011, the staff issue RAI 3.3.1.75-1 requesting that the applicant justify the use of a One-Time Inspection Program rather than the Open-Cycle Cooling Water System Program, which conducts periodic inspections to manage the aging of the elastomer materials exposed to raw water.

In its response dated June 3, 2011, the applicant stated that elastomers have been removed from the scope of the One-Time Inspection Program. The applicant further stated that it committed to manage the elastomeric components exposed to raw water with a new plant-specific AMP, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff finds the applicant’s response acceptable because it changed the aging management for elastomeric components exposed to raw water to a periodic inspection program, consistent with the GALL Report. The staff’s concern described in RAI 3.3.1.75-1 is resolved.

The staff’s evaluation of the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.3.7. In its review of components associated with item 3.3.1-75, the staff finds the applicant’s proposal to manage aging using the above program acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a periodic inspection program, which includes visual inspections to identify surface degradation.

LRA Table 3.3.1, item 3.3.1-75, addresses elastomer seals and components exposed to raw water environment, which are being managed for hardening and loss of strength due to elastomer degradation and loss of material due to erosion. For the AMR items that cite generic note E, the LRA credits the One-Time Inspection Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M20, “Open-Cycle Cooling Water System,” to ensure that these aging effects are adequately managed.

The staff noted that a plant-specific note for LRA Table 3.3.1, item 3.3.1-75, states hardening and loss of strength for elastomer components that are exposed to raw water will be detected and characterized by the One-Time Inspection Program; therefore, it is not completely clear to the staff if the applicant will be inspecting for loss of material by erosion. However, the visual inspections conducted for the One-Time Inspection Program would detect loss of material as well as hardening and loss of strength; therefore, the staff finds no issue with the applicant's plant-specific note.

For those components associated with generic note E, GALL Report AMP XI.M20 recommends in GALL Report, Revision 2, that elastomeric components be periodically examined consistent with the examinations described in AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." GALL Report AMP XI.M38 recommends that manual or physical manipulation of flexible polymeric components is used to augment visual inspection to assess loss of material or strength. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the One-Time Inspection Program includes an enhancement to perform visual inspection and physical examination such as manipulation and prodding of elastomers. For AMR items addressing similar material, environment, and aging effects, the GALL Report recommends a periodic inspection program. As noted in SER Section 3.3.2.2.5, by letter dated April 20, 2011, the staff issued RAI 3.3.2.2.5-1 requesting that the applicant state what program will perform periodic inspections of the in-scope elastomeric components.

In its response dated May 24, 2011, the applicant revised the LRA to remove elastomers from the scope of the One-Time Inspection and to include elastomers in a new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also revised LRA Table 3.3.2-6, row 4, Table 3.3.2-14, row 172, and Table 3.3.2-21, row 16, for elastomer flex connections in a raw water environment to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage the aging effect of hardening and loss of strength. Furthermore, in its letter dated June 3, 2011, in response to RAI 3.3.2.2.13-1 (the staff's evaluation of RAI 3.3.2.2.13-1 is documented in SER Section 3.3.2.2.13), the applicant revised LRA Tables 3.3.2-6, 3.3.2-14, and 3.3.2-21 to include the loss of material aging effect for elastomer flexible connections in a raw water environment and credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage the aging effect. The applicant included physical manipulation of elastomeric components during inspections in its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program.

The staff does not find the applicant's responses to RAIs 3.3.2.2.5-1 and 3.3.2.2.13-1 acceptable for this material, environment, and aging effects combination because the proposed program does not include a fixed periodicity of inspections, as recommended in GALL Report AMP XI.M20, "Open-Cycle Cooling Water System." By letter dated July 12, 2011, the staff issued RAI 3.3.2.2.5-2 requesting that the applicant propose a program with inspections based on a fixed periodicity.

In its response dated August 17, 2011, the applicant stated the following:

- The Collection, Drainage and Treatment Components Inspection Program has been revised to include physical manipulation of elastomeric material.
- In response to RAI B.2.9-3 dated July 22, 2011, the Collection, Drainage and Treatment Components Inspection Program was revised to require inspections with a fixed periodicity. In this response the applicant stated that every 10 years, starting 10 years prior to the period of extended operation, 20 percent or a maximum of 25 components for each material and environment combination will be inspected.

- The AMR items for elastomeric components exposed to raw water were revised such that hardening and loss of strength is being managed by the Collection, Drainage and Treatment Components Inspection Program.
- The Collection, Drainage and Treatment Components Inspection Program has been revised to state that, at a minimum, 10 percent of the elastomeric surface will be manipulated during inspections.

The staff finds the applicant's response acceptable because elastomeric components exposed to raw water will be periodically inspected, the inspections will include visual and physical manipulation techniques, the inspection sample size is consistent with the GALL Report AMPs XI.M32 and XI.M33, and the inspections will include at least 10 percent of the surface. The staff's concerns described in RAIs 3.3.2.2.5-1, 3.3.2.2.5-2, and 3.3.2.2.13-1 are resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.18 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 steel bolting, piping, and piping components exposed to raw water, which are being managed for loss of material. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage the aging effect for components that are exposed to raw water not from the open-cycle cooling water system. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the aging. In its review of components associated with item 3.3.1-76, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage the aging of steel piping, piping components, piping elements, and bolting through the use of periodic opportunistic visual inspections using a VT-3 or equivalent inspection technique.

The staff's evaluation of the applicant's Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the components covered by this AMP are associated with systems that do not transfer heat to the ultimate heat sink and, as such, do not meet the definition of an open cycle cooling water system. In its review of components associated with item 3.3.1-76, the staff finds the applicant's proposal to manage aging using the specified program acceptable because the Collection, Drainage, and Treatment Components Inspection Program includes periodic opportunistic visual inspections, which are adequate to detect and manage loss of material, consistent with the guidance in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.19 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-78, addresses stainless steel and copper-alloy piping, piping components, and tanks exposed to raw water, which are being managed for loss of material. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage the aging effect for components that are exposed to raw water not from the open-cycle cooling water system. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the aging. In its review of components associated with item 3.3.1-78, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage the aging of stainless steel and copper-alloy piping, piping components, piping elements, and tanks through the use of periodic opportunistic visual inspections using a VT-3 or equivalent inspection technique.

The staff's evaluation of the applicant's Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the components covered by this AMP are associated with systems that do not transfer heat to the ultimate heat sink and, as such, do not meet the definition of an open cycle cooling water system. In its review of components associated with item 3.3.1-78, the staff finds the applicant's proposal to manage aging using the specified program acceptable because the Collection, Drainage, and Treatment Components Inspection Program includes opportunistic periodic visual inspections, which are adequate to detect and manage loss of material, consistent with the guidance in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.20 Loss of Material Due to Pitting and Crevice Corrosion, and Fouling

LRA Table 3.3.1, item 3.3.1-79, addresses stainless steel piping, piping components, and tanks exposed to raw water, which are being managed for loss of material. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage the aging effect for components that are exposed to raw water not from the open-cycle cooling water system. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the aging. In its review of components associated with item 3.3.1-79, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage the aging of stainless steel piping, piping components, piping elements, and tanks through the use of periodic opportunistic visual inspections using a VT-3 or equivalent inspection technique.

The staff's evaluation of the applicant's Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the components covered by this AMP are associated with systems that do not transfer heat to the ultimate heat sink and, as such, do not meet the definition of an open cycle cooling water system. In its review of components associated with item 3.3.1-79, the staff finds the applicant's proposal to manage aging using the specified program acceptable because the Collection, Drainage, and Treatment Components Inspection Program includes periodic opportunistic visual inspections, which are adequate to detect and manage loss of material, consistent with the recommendations in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.21 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3.1, item 3.3.1-81, addresses copper-alloy piping and piping components exposed to raw water, which are being managed for loss of material. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage the aging effect for components that are exposed to raw water not from the open-cycle cooling water system. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the aging. In its review of components associated with item 3.3.1-81, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage the aging of copper-alloy piping, piping components, piping elements, and tanks through the use of periodic opportunistic visual inspections using a VT-3 or equivalent inspection technique.

The staff's evaluation of the applicant's Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the components covered by this AMP are associated with systems that do not transfer heat to the ultimate heat sink and, as such, do not meet the definition of an open cycle cooling water system. In its review of components associated with item 3.3.1-81, the staff finds the applicant's proposal to manage aging using the specified program acceptable because the Collection, Drainage, and Treatment Components Inspection Program includes periodic opportunistic visual inspections, which are adequate to detect and manage the aging effects consistent with the guidance in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.22 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3.1, item 3.3.1-83, addresses stainless steel and copper-alloy heat exchanger tubes exposed to raw water, which are being managed for reduction of heat transfer due to fouling. For the AMR items that cite generic note E, the LRA credits the Collection, Drainage, and Treatment Components Inspection Program to manage the aging effect for components that are exposed to raw water not from the open-cycle cooling water system. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the aging. In its review of components associated with item 3.3.1-83, for which the applicant cited generic note E, the staff noted that the Collection, Drainage, and Treatment Components Inspection Program proposes to manage the aging of steel piping, piping components, piping elements, and tanks through the use of periodic opportunistic visual inspections using a VT-3 or equivalent inspection technique.

The staff's evaluation of the applicant's Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. In its review of components associated with item 3.3.1-83, the staff finds the applicant's proposal to manage aging using the Collection, Drainage, and Treatment Components Inspection Program acceptable because the program includes periodic opportunistic visual inspections, which are adequate to detect and manage the reduction of heat transfer due to fouling, consistent with the recommendations in the GALL Report.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.23 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-90, addresses stainless steel and steel with stainless steel cladding piping, piping components, piping elements, tanks, and fuel storage racks exposed to treated borated water greater than 60 °C (140 °F), which are being managed for cracking due to SCC. The LRA credits the PWR Water Chemistry Program and the One-Time Inspection Program for adequate aging management of cracking. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," to ensure that these aging effects are adequately managed. The associated AMR items cite generic note E.

For those items associated with generic note E, GALL Report AMP XI.M2 recommends using water chemistry control to manage aging of these AMR items. In its review of the components associated with item 3.3.1-90, for which the applicant cited generic note E, the staff noted that the PWR Water Chemistry Program proposes to manage aging through the use of preventive measures, including water chemistry control, while the One-Time Inspection Program will use a one-time inspection to confirm the effectiveness of the PWR Water Chemistry Program.

The operating experience described in LER 1998-002-01 is closely related to the aging management of cracking due to SCC in stainless steel piping and tanks in the makeup and purification system, as addressed in LRA Table 3.3.2-18. This LER indicates that the degradation of resin beads in purification demineralizer resulted in the release of sulfur compounds, which caused extensive pitting of the demineralizer internal screen and the breakthrough of the resin beads to the downstream piping. The staff noted that a release of sulfur compounds can facilitate SCC in stainless steel components. However, LRA Table 3.3.2-18 does not address cracking due to SCC for stainless steel demineralizer tanks, including internal screens and filter housing. For stainless steel piping that has been identified as susceptible to SCC, the applicant proposed the PWR Water Chemistry Program and One-Time Inspection Program to manage this aging effect. The staff also noted that if operating experience indicates that SCC has occurred in the stainless steel components exposed to these sulfur compounds due to the resin degradation, the applicant needs to justify why the One-Time Inspection Program is adequate compared to a periodic inspection to manage the cracking due to SCC.

By letter dated May 2, 2011, the staff issued RAI 3.3.2.18-1 requesting that the applicant describe whether or not the stainless steel components in the makeup and purification system, which were previously exposed to sulfur compounds, have experienced SCC. The applicant was also asked to justify why cracking due to SCC is not an AERM for the stainless steel demineralizer tanks, including internal screens and filter housing. In addition, if the stainless steel components have experienced SCC, the staff asked the applicant to justify why the One-Time Inspection Program is adequate to manage SCC instead of a program that includes periodic inspections.

In its response dated June 3, 2011, the applicant stated that a review of its operating experience revealed that the stainless steel components in the makeup and purification system, previously exposed to sulfur compounds, have not experienced SCC. The applicant explained that SCC is not an AERM for the stainless steel demineralizer tanks, including internal screen and filter housing, because the temperature in this system under normal operations is below 120 °F, which is less than the SCC threshold temperature (140 °F) in treated water. The applicant stated that the LER did not identify cracking due to SCC as an apparent cause of the screen mesh failure, and as corrective actions, the letdown flow path was flushed and a resin control program was instituted to prevent reoccurrence. The applicant further stated that no additional operating experience has been identified to support the staff's concern that short-term exposure to sulfur compounds will result in cracking due to SCC in stainless steel components.

The staff finds the applicant's response acceptable for the following reasons:

- The applicant confirmed that plant-specific operating experience has not identified any SCC of the stainless steel components in the makeup and purification system; therefore, the use of a one-time inspection is appropriate.
- The temperature of the treated water in this system, under normal operation, is below the threshold temperature in which SCC occurs.
- The applicant initiated corrective actions to flush the letdown flow path and institute a resin control program to prevent reoccurrence of a resin bead breakthrough to the downstream piping.

The staff's concerns described in RAI 3.3.2.18-1 are resolved.

The staff's evaluations of the applicant's PWR Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of the components associated with item 3.3.1-90, the staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program and One-Time Inspection Program acceptable. The PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and includes the actions that will be performed if the parameters exceed the limits. The One-Time Inspection Program includes a one-time inspection of select components to confirm the effectiveness of the PWR Water Chemistry Program for managing the effects of aging due to SCC.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.24 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-91, addresses stainless steel and steel with stainless steel cladding piping, piping components, and piping elements exposed to treated borated water, which are being managed for loss of material due to pitting and crevice corrosion. The staff noted that the applicant also applies this item to CASS pump casings and valve bodies, stainless steel piping, piping components, and piping elements in the non-Class 1 portions of the RCS and RCPB, and stainless steel heat exchanger components and tanks. The LRA credits the PWR Water Chemistry and One-Time Inspection Programs to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," to ensure that these aging effects are adequately managed. The AMR items associated with the One-Time Inspection Program cite generic note E.

For these items, GALL Report AMP XI.M2 recommends using water chemistry controls to manage the aging. In its review of components associated with item 3.3.1-91, the staff noted that the PWR Water Chemistry and One-Time Inspection Programs propose to manage the aging of stainless steel piping, piping components, piping elements, heat exchanger components, and tanks and CASS pump casings and valve bodies through the use of water chemistry controls and a one-time inspection to verify the effectiveness of the PWR Water Chemistry Program.

The applicant stated that for item 3.3.1-91, the applicability is limited to stainless steel piping, piping components, piping elements, heat exchanger components, and tanks exposed to treated borated water. The staff noted that a search of the applicant's USAR confirmed that no in-scope steel with stainless steel cladding components exposed to treated borated water are present in the auxiliary systems.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-91, the staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program and the One-Time Inspection Program acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and identifies the actions required if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.25 No Aging Effect Identified

LRA Table 3.3.1, item 3.3.1-96, addresses steel and stainless steel piping, piping components, and piping elements exposed to concrete, which have no identified aging effect that requires management. The staff noted that in LRA Table 3.5.2-12, the applicant also applied this item to EDG fuel oil storage tank hold down restraints. In its review of components associated with item 3.3.1-96, for which the applicant cited generic note A, the staff noted that the updated staff guidance in SPR-LR, Revision 2, Table 3.3-1, item 112, recommends that steel piping, piping components, and piping elements exposed to concrete do not need to be age managed, provided that the attributes of the concrete are consistent with ACI 318 or ACI 349 and that plant operating experience indicates no degradation of the concrete. The staff also noted that if the conditions are not met, further evaluation is recommended. The staff further noted that LRA Section B.2.39, "Structures Monitoring Program," includes several examples of plant-specific operating experience where water leakage through the concrete has occurred. By letter dated May 2, 2011, the staff issued RAI 3.3.2.3.14-3 requesting that the applicant state whether concrete degradation has occurred in the vicinity of steel components embedded in concrete. If so, the staff asked the applicant to state how aging will be managed.

In its response dated June 17, 2011, the applicant stated that concrete degradation has not occurred such that water may have intruded into the concrete that surrounds the subject steel components in the fire protection system, service water system, station plumbing, drains, sumps system, and yard structures. The applicant also stated that review of the plant-specific operating experience does not suggest that any of the identified leakage has had any effect on embedded piping or on the embedded EDG fuel oil tank hold down restraints. The applicant further stated that the Structures Monitoring Program, with the enhancements described in the responses to RAIs B.2.39-3 and B.2.39-6, will effectively manage water intrusion into concrete by including concrete core bore evaluation and acceptance criteria for visual inspection of concrete.

The staff finds the applicant's response acceptable because concrete degradation allowing water intrusion has not occurred in the vicinity of the subject steel components, and the concrete bore evaluations and visual inspections in the Structures Monitoring Program are capable of ensuring that any future concrete degradation will be detected prior to allowing water intrusion to cause significant degradation of the steel components. Therefore, the staff's concern described in RAI 3.3.2.3.14-3 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

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 and 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

- 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 audited and reviewed the applicant's evaluations to determine if 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

LRA Section 3.3.2.2.1, associated with LRA Table 3.3.1, items 3.3.1-1 and 3.3.1-2, addresses steel crane structural girders exposed to air-indoor uncontrolled (external) and steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air-indoor uncontrolled, treated borated water, or treated water are being managed for cumulative fatigue damage. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, and TLAA are required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that TLAA identified for fatigue are discussed in LRA Section 4.

The staff reviewed LRA Section 3.3.2.2.1 against the criteria in SRP-LR Section 3.3.2.2.1, which states that fatigue of these auxiliary system components is a TLAA, as defined in 10 CFR 54.3, and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements in 10 CFR 54.21(c)(1) and in accordance with SRP-LR Section 4.3, "Metal Fatigue Analysis." The staff reviewed the applicant's AMR items and finds that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage in steel cranes structural girders exposed to air-indoor uncontrolled (external) and steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air-indoor uncontrolled, treated borated water, or treated water, except as identified below.

In its review of the applicant's metal fatigue AMR assessment for steel cranes—structural girders exposed to air-indoor uncontrolled (external) environment of the auxiliary systems (item 3.3.1-1), the staff noted that, in LRA Section 4.1, the applicant did not identify TLAA associated with fatigue or cyclic loads of the steel cranes. The staff's evaluation of the absence of such TLAA is documented in SER Section 4.1.

The staff also identified that the applicant did not include the applicable AMR items in LRA Tables 3.3.2-y for the TLAAs associated with fatigue of non-Class 1 piping and in-line components. The staff noted that LRA Section 4.3.3.1 discusses the TLAAs associated with fatigue of non-Class 1 piping and in-line components and states that these TLAAs will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). Therefore, by letter dated May 2, 2011, the staff issued RAI 3.2.2.2.1-1 requesting that the applicant justify this discrepancy. The details of RAI 3.2.2.2.1-1 and the staff's evaluation of the applicant's response are documented in SER Section 3.2.2.2.1. As discussed in SER Section 3.2.2.2.1, the staff's concern described in RAI 3.2.2.2.1-1 is resolved.

Based on the staff's review, it concludes that the applicant met the SRP-LR Section 3.3.2.2.1 criteria. For those AMR items that apply to LRA Section 3.3.2.2.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3 documents the staff's review of the applicant's evaluation of the TLAA for these components.

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

LRA Section 3.3.2.2.2, associated with LRA Table 3.3.1, item 3.3.1-3, addresses stainless steel heat exchanger tubes exposed to treated water. The applicant stated that this AMR item is not applicable because the auxiliary systems do not contain stainless steel heat exchanger tubes that are exposed to treated water and subject to an AMR. To verify this, the staff reviewed LRA Section 3.3 and noted that although there are no in-scope stainless steel heat exchanger tubes exposed to treated water present in the auxiliary systems, LRA Table 3.3.2-18 has stainless steel heat exchanger tubes exposed to treated borated water with an intended function of heat transfer. However, the applicant identified this AMR item with generic note H. The criteria in SRP-LR Section 3.3.2.2.2 state that the existing AMP monitors and controls primary water chemistry to manage reduction of heat transfer due to fouling. The SRP-LR also states that although the existing AMP relies on control of water chemistry to manage this aging effect, it may not always have been adequate to preclude fouling. The SRP-LR recommends that the effectiveness of the Water Chemistry Control Program be confirmed and states that a one-time inspection is an acceptable verification method. The applicant has credited the PWR Water Chemistry and One-Time Inspection Programs to manage this aging effect.

The staff's evaluations of the applicant's PWR Water Chemistry and the One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-3, the staff finds that the applicant met the further evaluation criteria and the applicant's proposal to manage aging using the specified programs is acceptable because the PWR Water Chemistry Program includes control of detrimental contaminants below the levels known to cause fouling, and the One-Time Inspection Program will verify the effectiveness of the chemistry controls by inspecting a sample of similar components exposed to the same environment.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.2 criteria. For those items that apply to LRA Section 3.3.2.2.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.3 against the following criteria in SRP-LR Section 3.3.2.2.3:

(1) LRA Section 3.3.2.2.3.1, associated with LRA Table 3.3.1, item 3.3.1-4, addresses cracking due to SCC in stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution greater than 60 °C (140 °F). The applicant stated that this item is not applicable because this is only used at BWR plants, and the applicant's plant is a PWR. The staff reviewed LRA Sections 2.3.3 and 3.3 and the USAR. In its review, the staff finds the applicant's claim acceptable because its review has not revealed any information indicating that in-scope stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution greater than

140 °F (60 °C) are present in the auxiliary systems. In addition, the staff finds that LRA item 3.3.1-4, which is associated with cracking due to SCC of stainless steel components exposed to sodium pentaborate solution greater than 140 °F (60 °C) of the BWR standby liquid control system, is not applicable to the applicant's plant, which is a PWR.

(2) LRA Section 3.3.2.2.3.2, associated with LRA Table 3.3.1, item 3.3.1-5, addresses stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 140 °F (60 °C). The applicant stated that the auxiliary systems do not contain stainless steel or stainless steel clad heat exchanger components that are exposed to treated water greater than 140 °F (60 °C) and subject to an AMR; therefore, this item is not applicable to Davis-Besse. The staff reviewed LRA Section 3.3 and noted that although there were no in-scope stainless steel heat exchanger tubes exposed to treated water greater than 140 °F (60 °C) present in the auxiliary systems, there are several systems with heat exchanger tubes exposed to treated borated water greater than 140 °F (60 °C). As a result, the staff considered this aging effect to be applicable to these components. However, the staff also noted that the applicant aligned these components with item 3.3.1-7, which is associated with non-regenerative heat exchanger tubes, and cited generic note E indicating a different AMP or plant-specific AMP was credited to manage this aging effect. The staff further noted that the applicant also cited plant-specific note 315 for these components, which states that the One-Time Inspection Program will provide verification of PWR Water Chemistry Program effectiveness. The staff finds the applicant's determination, that item 3.3.1-5 is not applicable, acceptable because the applicant aligned the applicable components with item 3.3.1-7, which has comparable acceptance criteria as item 3.3.1-5, and will adequately manage this aging effect.

(3) LRA Section 3.3.2.2.3.3, associated with LRA Table 3.3.1, item 3.3.1-6, addresses stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust, which are being managed for cracking due to SCC by the One-Time Inspection program. The criteria in SRP-LR, Section 3.3.2.2.3.3, states that cracking due to SCC could occur for stainless steel piping, piping components, piping elements, and tanks exposed to diesel exhaust. The SRP-LR also states that the acceptance criteria described in BTP RLSB-1 should be used to ensure that a plant-specific AMP will adequately manage this aging effect. In addition, SRP-LR also recommends that this aging effect be managed with GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The applicant addressed the further evaluation criteria of the SRP-LR by stating that cracking due to SCC for stainless steel diesel engine exhaust piping components, though not expected to occur, will be detected and characterized by the One-Time Inspection Program.

In its review of components associated with item 3.3.1-06, the staff noted that one-time inspections are appropriate for managing cracking in environments that are controlled and consistent over time, such as fuel oil, lube oil, and treated water. However, the staff also noted that where environments are not controlled and may not be consistent over time, a single inspection may not be adequate to predict future degradation. By letter dated May 2, 2011, the staff issued RAI 3.3.2.2.3.3-1, noting that the GALL Report, recommends a periodic inspection program to manage this combination of material, environment, and aging effect and asking the applicant to provide justification that a one-time inspection provides adequate aging management for the associated components.

In its response dated June 3, 2011, the applicant stated that the LRA is revised to include a new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program and referred to its letter dated May 24, 2011, for the related response to RAI 3.3.2.71-2. The applicant stated that this program consists of inspections of the internal surfaces of aluminum, copper alloy, stainless steel, and steel components exposed to air, condensation, diesel exhaust, or moist air, and external cooling coil surfaces. The applicant further stated that this is a periodic inspection program, including opportunistic inspections when components are opened for maintenance, repair or surveillance, that will confirm that existing environmental conditions are not causing material degradation that could result in a loss of component intended function during the period of extended operation. For all AMR items associated with LRA Table 3.3.1, item 3.3.1-06, where the LRA originally credited the One-Time Inspection Program to manage cracking due to SCC, the applicant revised the LRA to state that cracking due to SCC will be managed by its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff finds the applicant's response acceptable because the applicant replaced the originally proposed one-time inspection of LRA Table 3.3.1, item 3.3.1-6, components with a periodic inspection program. The staff's concern described in RAI 3.3.2.2.3.3-1 is resolved.

The staff's evaluation of the applicant's plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds that the applicant met the further evaluation criteria, and the applicant's specified program is acceptable to manage cracking due to SCC of stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes the following:

- enhanced visual inspections, which are capable of detecting SCC of stainless steel components and which will be supplemented by other established NDE techniques, as appropriate
- periodic inspections, which, provide ongoing opportunities to detect the aging effect if it should occur
- requirements for implementing corrective actions if unacceptable indications of cracking is found

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.3, item 3, criteria. For the AMR items that apply to LRA Section 3.3.2.2.3.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.3 criteria. For those items that apply to LRA Section 3.3.2.2.3, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.4 against the following criteria in SRP-LR Section 3.3.2.2.4:

(1) LRA Section 3.3.2.2.4.1, associated with LRA Table 3.3.1, item 3.3.1-7, addresses cracking due to SCC and cyclic loading in stainless steel non-regenerative heat exchanger components exposed to treated borated water greater than 140 °F (60 °C) in the chemical and volume control system, which are being managed by the PWR Water Chemistry and One-Time Inspection Programs. The criteria in SRP-LR Section 3.3.2.2.4.1 states that the existing AMP monitors and controls primary water chemistry to manage cracking due to SCC; however, control of water chemistry does not preclude cracking due to SCC and cyclic loading. The SRP-LR also states that the effectiveness of water chemistry control programs should be confirmed using a plant-specific AMP and an acceptable verification program includes temperature and radioactivity monitoring of the shell side water and eddy current testing of the tubes. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the seal return coolers in the makeup and purification system are stainless steel and are exposed to the above environment. The applicant also stated that the PWR Water Chemistry Program will manage this aging effect and that the effectiveness of the program will be confirmed by the One-Time Inspection Program. The applicant further stated that it selected the One-Time Inspection Program in lieu of eddy current testing of tubes, and it monitors temperature and radioactivity of shell side water by installed instrumentation. The applicant concluded by stating that it did not identify cracking due to cyclic loading as an AERM for these components.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff reviewed the applicant's PWR Water Chemistry Program and noted that it controls detrimental contaminants below the levels known to cause cracking. The staff also noted that the applicant credited its One-Time Inspection Program to verify the effectiveness of the PWR Water Chemistry Program to manage this aging effect. However, the LRA did not discuss the letdown coolers in the makeup and purification system, which are equivalent to the non-regenerative heat exchangers in the chemical and volume control system. It was not clear to the staff if these non-regenerative heat exchangers will be included in the sample of components to be inspected in the One-Time Inspection Program and what inspection techniques will be used.

By letter dated May 2, 2011, the staff issued RAI 3.3.2.2.4-1, asking the applicant to clarify whether these non-regenerative heat exchangers will be included in the sample of components to be inspected by the One-Time Inspection Program and to describe the NDE techniques that will be used in lieu of eddy current testing of tubes. In addition, the staff requested that the applicant provide its bases for concluding that cracking due to cyclic loading was not an AERM for these components.

In its response dated June 3, 2011, the applicant stated that the letdown coolers are periodically replaced based on a qualified life of seven RFOs, as discussed in the same letter for RAI 2.3.3.18-2; therefore, since they are short-lived, the coolers are not subject to an AMR. Based on this, the applicant also stated that NDE techniques will not be used to verify the effectiveness of the PWR Water Chemistry Program to manage cracking due to SCC of the non-regenerative heat exchanger components, and cracking due to cyclic loading is not identified as an AERM for the same reason. The applicant also revised LRA Table 3.3.2-18 to not credit Table 3.3.1, item 3.3.1-7, but, instead, to credit Table 3.3.1, item 3.3.1-90, for management of cracking in the seal return coolers. The staff noted that the applicant maintained the use of both the PWR Water Chemistry and One-Time Inspection Programs for managing cracking even though the second program is not recommended by item 3.3.1-90. As a result, the applicant also revised LRA Table 3.3.1, item 3.3.1-7, to state that this item is not applicable because the auxiliary systems do not contain stainless steel non-regenerative heat exchanger components exposed to treated borated water greater than 140 °F (60 °C) and subject to an AMR.

However, as a result of additional questions from the staff regarding the basis of the replacement frequency for the letdown coolers, the applicant provided additional information in its responses dated June 3, 2011, August 17, 2011, October 21, 2011, and November 23, 2011, to RAIs 2.3.3.18-2, 2.3.3.18-3, and 2.3.3.18-4. As a result, the applicant no longer considered the letdown coolers to be short-lived components and consequently decided to age manage them consistent with SRP-LR Table 3.3.1, item 3.3.1-7, and revised the LRA Section 3.3.2.2.4, item 1 accordingly. This effectively superseded the applicant's response to RAI 3.3.2.2.4-1.

In its supplemental response to RAI 2.3.3.18-4, dated November 23, 2011, the applicant stated that the letdown coolers and the seal return coolers consist of stainless steel heat exchanger components exposed to treated borated water greater than 140 °F (60 °C), and that cracking due to SCC in these components is managed by the PWR Water Chemistry Program. The applicant also stated that the One-Time Inspection Program will provide verification of the effectiveness of the PWR Water Chemistry Program. In addition, the applicant revised its Closed Cooling Water Chemistry Program to include an enhancement to ensure that CCW radiochemistry is sampled on a weekly interval to verify the integrity of the letdown coolers and seal return coolers.

As noted earlier in this section, the staff's reviews of the PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In addition, the staff's evaluation of the Closed Cooling Water Chemistry Program is documented in SER Section 3.0.3.2.4. Based on the applicant's response to RAI 2.3.3.18-3, the staff noted that the applicant had demonstrated the effectiveness of sampling the CCW radiochemistry on a weekly basis to identify leakage of the letdown cooler tubes at an early stage, and to replace the coolers before their CLB function was challenged through a ruptured tube. In addition, the applicant provided an acceptable basis for concluding that the CLB function of the letdown coolers was not challenged because CCW activity levels remained very low, RCS unidentified leakage remained essentially unchanged, radiation monitoring alarms were not triggered, and no unexplained increases were observed in the CCW surge tank level.

In its review of components associated with item 3.3.1-7, the staff finds the applicant has met the further evaluation criteria and the applicant's proposal to manage aging using the above programs is acceptable because (1) the PWR Water Chemistry Program maintains contaminants below levels that promote SCC, (2) the One-Time Inspection

Program will verify the effectiveness of the PWR Water Chemistry Program, and (3) the temperature and radioactivity of shell side water is monitored by installed instrumentation. In addition, the staff finds the applicant's proposal to use the enhanced Closed Cooling Water Chemistry Program in lieu of eddy current testing acceptable because this approach has been demonstrated to identify tube leakage prior to challenging the CLB function due to a tube rupture in the letdown coolers. Based on the above discussion, the staff's concerns described in RAIs 3.3.2.2.4-1, 2.3.3.18-2, 2.3.3.18-3, and 2.3.3.18-4 are resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.4.1 criteria. For those items that apply to LRA Section 3.3.2.2.4.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.4.2, associated with LRA Table 3.3.1, item 3.3.1-8, addresses cracking due to SSC and cyclic loading in stainless steel regenerative heat exchanger components exposed to treated borated water greater than 140 °F (60 °C). The applicant stated that this item is not applicable because the auxiliary systems do not contain stainless steel regenerative heat exchanger components in this environment. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that no in-scope stainless steel regenerative heat exchanger components exposed to treated borated water greater than 140 °F (60 °C) are present in the auxiliary systems; therefore, it finds the applicant's claim acceptable.

(3) LRA Section 3.3.2.2.4.3, associated with LRA Table 3.3.1, item 3.3.1-9, addresses cracking due to SCC and cyclic loading in stainless steel high-pressure pump casing in the PWR chemical and volume control system exposed to treated water. The applicant stated that this item is not applicable because cracking due to SCC and cyclic loading was not identified as an AERM for the stainless steel pump casing. In its review, the staff noted that the LRA does not provide sufficient information to justify why cracking due to SCC and cyclic loading is not an AERM for the stainless steel pump casing for the high-pressure pumps in the makeup and purification system.

By letter dated May 2, 2011, the staff issued RAI 3.3.2.2.4.3-1 requesting that the applicant provide the technical justification as to why neither cracking due to SCC nor cracking due to cyclic loading is an AERM for the stainless steel high-pressure pump casing. The applicant was further requested to provide additional information on how these aging mechanisms will be managed during the period of extended operation if it is determined that the stainless steel pump casing for the high-pressure pumps are susceptible to SCC and cyclic loading under their exposure conditions.

In its response dated June 3, 2011, the applicant stated that cracking due to SCC is not an AERM for stainless steel in a treated water environment if the temperature is less than 140 °F. The applicant also stated that the stainless steel makeup pumps are exposed to treated borated water that is maintained at 120 °F or below, which is not an environment in which SCC would occur. However, the applicant stated that the stainless steel high-pressure pump casings are susceptible to cracking due to cyclic loading, and the LRA was revised to include this aging effect. In addition, the applicant stated that it will manage cracking due to cyclic loading of the stainless steel makeup pump casings by the PWR Water Chemistry Program and One-Time Inspection Program.

Based on its review, the staff finds the applicant's response acceptable because the applicant revised the LRA to manage cracking due to cyclic loading of the components using the PWR Water Chemistry Program and One-Time Inspection Program, consistent with the GALL Report. Additionally, the temperature of the borated water environment is below the threshold temperature (140 °F) for SCC in treated water so that cracking due to SCC is not applicable to the components consistent with the GALL Report. The staff's concern described in RAI 3.3.2.2.4.3-1 is resolved.

The staff's evaluations of the applicant's PWR Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry Program and One-Time Inspection Program is acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and includes the actions that will be performed if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes a one-time inspection of selected components to confirm the effectiveness of the PWR Water Chemistry Program for adequate aging management of cracking in a consistent manner with the GALL Report and SRP-LR.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.4.3 criteria. For those items that apply to LRA Section 3.3.2.2.4.3, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(4) LRA Section 3.3.2.2.4.4, associated with LRA Table 3.3.1, item 3.3.1-10, addresses high strength steel bolting exposed to air with steam or water leakage, which is being managed for cracking due to cyclic loading or SCC by the Bolting Integrity Program. The criteria in SRP-LR, Table 3.3-1, item 10, indicate that cracking due to SCC and cyclic loading could occur for high strength steel closure bolting exposed to air with steam or water leakage. The SRP-LR recommends GALL Report AMP XI.M18, "Bolting Integrity," to manage the aging effect, which is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Bolting Integrity Program will be used to verify cracking due to SCC in high strength steel bolting.

The staff's evaluation of the applicant's Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff noted that the applicant's Bolting Integrity Program will use VT-1 examinations to detect cracking. The staff also noted that the applicant's Bolting Integrity Program includes proper selection, assembly, and maintenance procedures to assist in mitigating the aging effect from occurring. In its review of components associated with item 3.3.1-10, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the Bolting Integrity Program is acceptable because it will be using mitigation and preventive maintenance activities combined with examination techniques to detect cracking prior to the loss of intended function.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.4.4, criteria. For those items that apply to LRA Section 3.3.2.2.4.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.4 criteria. For those AMR items that apply to LRA Section 3.3.2.2.4, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.3.2.2.5 against the following criteria in SRP-LR Section 3.3.2.2.5:

(1) LRA Section 3.3.2.2.5.1, associated with LRA Table 3.3.1, item 3.3.1-11, addresses elastomer seals and components exposed to air-indoor uncontrolled internal/external environments, which are being managed for hardening and loss of strength due to elastomer degradation by the External Surface Monitoring Program. The criteria in SRP-LR Section 3.3.2.2.5.1 states that hardening and loss of strength due to elastomer degradation may occur in elastomeric seals and components associated with 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. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the External Surfaces Monitoring Program is adequate to manage the aging effects of these components.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff noted that the External Surfaces Monitoring Program uses periodic visual inspections and surveillance activities to monitor for materials degradation and is supplemented by the One-Time Inspection Program. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the One-Time Inspection Program includes an enhancement to perform visual inspection and physical examination such as manipulation and prodding of elastomers. It is not clear to the staff whether the applicant will perform periodic or only a one-time visual and physical examination of the in-scope elastomeric components. It is also not clear to the staff how an external examination will detect hardening and loss of strength on the internal surfaces of all elastomers. By letter dated April 20, 2011, the staff issued RAI 3.3.2.2.5-1, requesting that the applicant do the following:

- state what program will perform periodic inspections of the in-scope elastomeric components

- if the External Surfaces Monitoring Program is used to manage aging of elastomeric components, revise it to include physical manipulation of elastomeric materials or state how it would be effective at determining if hardening or loss of strength has occurred
- state the basis for how hardening and loss of strength occurring on the interior surfaces of elastomeric components will be effectively detected with only an inspection of the exterior surface of the component

In its letter dated May 24, 2011, the applicant revised LRA Section 3.3.2.2.5.1 to state that the hardening and loss of strength due to elastomer degradation in elastomer seals and components in the auxiliary systems, which are exposed to air-indoor uncontrolled (internal and external), are managed by the External Surfaces Monitoring Program supplemented by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. In its review of components associated with item 3.3.1-11 and the applicant's response to RAI 3.3.2.2.5-1, the staff does not find that the applicant met the further evaluation criteria. Therefore, the staff finds that the applicant's proposal to manage aging using the External Surfaces Monitoring Program supplemented by its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is not acceptable. GALL Report, Revision 2, items EP-58 and EP-59, recommend that elastomeric materials exposed to air-indoor uncontrolled (internal and external) be managed for hardening and loss of strength by GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," and GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components." Both AMP XI.M36 and XI.M38 recommend that elastomeric materials be physically manipulated during inspections to detect hardening and loss of strength and that the manipulation should include 10 percent of the available surface area. By letter dated July 12, 2011, the staff issued RAI 3.3.2.2.5-2 requesting that the applicant revise the External Surfaces Monitoring Program to include physical manipulation of elastomeric materials and revise the External Surfaces Monitoring Program to state the minimum available surface area that will be manipulated during inspections of elastomeric materials. If the minimum available surface area that will be manipulated during inspections of elastomeric materials is less than 10 percent, the staff asked the applicant to state the basis for how the inspection will sufficiently identify the hardening and loss of strength aging effects.

In its response dated August 17, 2011, the applicant stated that the External Surfaces Monitoring Program has been revised to include physical manipulation of at least 10 percent of the surface area of elastomeric material. In its May 24, 2011, Amendment No. 7, LRA Section B.2.41, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program," was revised to require physical manipulation of at least 10 percent of the surface area of elastomeric material.

The staff finds the applicant's response acceptable because elastomeric components exposed to air-indoor uncontrolled will be periodically inspected internally and externally, the inspections will include visual and physical manipulation techniques, and the inspections will include at least 10 percent of the surface. The staff's concerns described in RAIs 3.3.2.2.5-1 and 3.3.2.2.5-2 are resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.5.1, criteria. For those items that apply to LRA Section 3.3.2.2.5.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.5.2, associated with LRA Table 3.3.1, item 3.3.1-12, addresses elastomer lined components exposed to treated borated water in the SFP cooling and cleanup system, which are being managed for hardening and loss of strength due to elastomer degradation by the One-Time Inspection Program. The criteria in SRP-LR Section 3.3.2.2.5.2 states that hardening and loss of strength due to elastomer degradation may occur in elastomer linings of the filters, valves, and ion exchangers in SFP cooling and cleanup systems exposed to treated water or to treated borated water. The SRP-LR also states that the GALL Report recommends that a plant-specific AMP be evaluated that determines and assesses the qualified life of the elastomeric liners in the environment to ensure that these aging effects are adequately managed. The applicant addressed the further evaluation criteria of the SRP-LR by stating that there are no elastomer linings in the SFP cooling and cleanup system that are exposed to treated water or to treated borated water and are subject to an AMR. The applicant stated that the spent resin transfer system contains elastomer components (not linings) exposed to the treated water greater than 140 °F (greater than 60 °C) environment that are susceptible to hardening and loss of strength, which will be managed by the One-Time Inspection Program. The staff noted that the applicant did not incorporate the recommendation to determine and assess the qualified life of the elastomeric components, as stated in SRP-LR Section 3.3.2.2.5.2; however, SRP-LR Revision 2 has removed this recommendation. Therefore, the applicant's proposal complies with the current staff position.

The applicant is using item 3.3.1-12 to address elastomer flex hoses exposed to treated water greater than 140 °F (greater than 60 °C). The staff noted that elastomer flex hoses, when exposed to treated water greater than 140 °F (greater than 60 °C), will have the same aging effect of hardening and loss of strength as elastomer lined components in the same environment. The applicant stated that for item 3.3.1-12, the applicability is limited to the spent resin transfer system. The staff noted that a search of the applicant's USAR for the SFP cooling and cleanup system confirmed that no in-scope elastomer lined components exposed to treated borated water are present in the SFP cooling and cleanup system.

The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the One-Time Inspection Program has been enhanced to include visual and physical examination, such as manipulation and prodding of elastomers (flexible connections). However, the applicant stated in the program description that one-time inspections are used to address situations where the following is true:

- An aging effect is not expected to occur, but there is insufficient data to completely rule it out.
- An aging effect is expected to progress very slowly in the specified environment, and the local environment may be more adverse.

- The characteristics of the aging effect include a long incubation period.

Since the elastomeric components are exposed to treated water greater than 140 °F (greater than 60 °C), aging effects are expected to occur; therefore, the One-Time Inspection Program is not an acceptable AMP. By letter dated April 20, 2011, the staff issued RAI 3.3.2.2.5-1 requesting that the applicant state what program will perform inspections during the period of extended operation of the in-scope elastomeric components.

In its response dated May 24, 2011, the applicant revised LRA Section 3.3.2.2.5.2 to remove reference to the One-Time Inspection Program and stated that hardening and loss of strength for these elastomer components will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also revised Table 3.3.2-28, row 5, to delete the One-Time Inspection Program as an AMP and, instead, referenced the Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff's evaluation of the applicant's Inspection of Internal Surface in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7.

In its review of components associated with item 3.3.1-12 and the applicant's response to RAI 3.3.2.2.5-1, the staff finds that the applicant met the further evaluation criteria. The staff also finds that the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is acceptable for the following reasons:

- The new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes visual and physical (manipulation or prodding) examination of subject non-metallic, flexible (elastomeric) components in various environments for evidence of hardening or loss of strength due to thermal exposure, ultraviolet exposure, or ionizing radiation.
- GALL Report, Revision 2, item AP-101, recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," for elastomeric materials exposed to treated water.
- In its May 24, 2011, Amendment No. 7, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program was revised to require physical manipulation of at least 10 percent of the surface area of elastomeric material.

The staff's concern described in RAI 3.3.2.2.5-1 is resolved.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.5.2, criteria. For those items that apply to LRA Section 3.3.2.2.5.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.5 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

LRA Section 3.3.2.2.6, associated with LRA Table 3.3.1, item 3.3.1-13, addresses Boral® and boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water, which are being managed for reduction of neutron-absorbing capacity and loss of material due to general corrosion by the PWR Water Chemistry and Boral® Monitoring Programs. The criteria in SRP-LR Section 3.3.2.2.6 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur for neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or treated borated water. The SRP-LR also states that the GALL Report recommends a plant-specific AMP to ensure that these aging effects are adequately managed. The applicant addressed the further evaluation criteria by stating that the PWR Water Chemistry and Boral® Monitoring Programs will be used to manage reduction of neutron-absorbing capacity and loss of material due to general corrosion of the neutron-absorbing sheets exposed to treated borated water.

The staff's evaluation of the applicant's PWR Water Chemistry and Boral® Monitoring Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.3.2. In its review of components associated with item 3.3.1-13, the staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry and Boral® Monitoring Programs is acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the potential for aging and the Boral® Monitoring Program uses inspection techniques (e.g., in-situ neutron attenuation testing of Boral® and visual inspections) that will detect aging effects related to the neutron absorption and dimensional integrity.

On the basis of its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.6 criteria. For those items that apply to LRA Section 3.3.2.2.6, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7:

(1) LRA Section 3.3.2.2.7.1, associated with LRA Table 3.3.1, item 3.3.1-14, addresses steel piping, piping components, and piping elements exposed to lubricating oil, which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through periodic monitoring and control of contaminants, including water. The applicant further stated that this AMR item also applied to steel tanks, and bearing and gear housings, in the auxiliary systems that are exposed to lubricating oil.

LRA Section 3.3.2.2.7.1, associated with LRA Table 3.3.1, item 3.3.1-15, addresses loss of material in steel RCP oil collection system piping and valve bodies that are exposed to lubricating oil, which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through periodic monitoring and control of contaminants, including water.

LRA Section 3.3.2.2.7.1, associated with LRA Table 3.3.1, item 3.3.1-16, addresses steel RCP oil collection system and chemical and volume control system tanks exposed to lubricating oil, which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.3.2.2.7.1 against the criteria in SRP-LR Section 3.3.2.2.7.1, which states that loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the RCP oil collection system, exposed to lubricating oil (as part of the fire protection system).

In addition, the SRP-LR states that corrosion may occur at locations in the RCP oil collection tank where water from wash downs may accumulate; therefore, the effectiveness of the program should be verified to ensure that corrosion does not occur.

The staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with items 3.3.1-14, 3.3.1-15, and 3.3.1-16, the staff finds the applicant's proposal to manage aging using the One-Time Inspection Program and the Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.3.2.2.7, item 1; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7.1, criteria. For the AMR items that apply to LRA Section 3.3.2.2.7.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.7.2, associated with LRA Table 3.3.1, item 3.3.1-17, addresses steel piping, piping components, and piping elements exposed to treated water, which are being managed for loss of material due to general, pitting, and crevice corrosion by the PWR Water Chemistry Program and One-Time Inspection Program. The criteria in SRP-LR Section 3.3.2.2.7.2, states that loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, and piping elements in

the BWR reactor water cleanup and shutdown cooling systems exposed to treated water. The SRP-LR also states that the Water Chemistry Program relies on monitoring and control of water chemistry to mitigate degradation and a one-time inspection of select 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 addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to treated water is also applicable to some treated (unborated) water systems in PWRs and will be managed by the PWR Water Chemistry Program and One-Time Inspection Program.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-17, the staff finds that the applicant met the further evaluation criteria. The staff also finds the applicant's proposal to manage aging using the PWR Water Chemistry program and One-Time Inspection Program acceptable because the PWR Water Chemistry Program uses chemical sampling and corrective actions to ensure that impurities are minimized to reduce aging due to loss of material. The One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion, consistent with the recommendations in the GALL Report, Revision 2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7.2, criteria. For those items that apply to LRA Section 3.3.2.2.7.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) LRA Section 3.3.2.2.7.3, associated with LRA Table 3.3.1, item 3.3.1-18, addresses steel and stainless steel piping, piping components, and piping elements exposed to diesel exhaust, which are being managed for loss of material due to general (steel only), pitting, and crevice corrosion by the One-Time Inspection Program. The criteria in SRP-LR Section 3.3.2.2.7.3 state that loss of material due to general (steel only), pitting, and crevice corrosion could occur for steel and stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The SRP-LR also states that the acceptance criteria described in BTP RLSB-1 should be used to ensure that a plant-specific AMP will adequately manage this aging effect. In addition, SRP-LR, Revision 2, recommends the use of GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to manage this aging effect. GALL Report AMP XI.M38 recommends using periodic inspection to manage loss of material due to general, pitting, and crevice corrosion. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to general, pitting, and crevice corrosion for steel and stainless steel diesel engine exhaust piping, piping components, and piping elements will be detected and characterized by the One-Time Inspection Program.

In its review of components associated with item 3.3.1-18, the staff noted that one-time inspections are appropriate for managing loss of material in environments that are controlled and consistent over time, such as fuel oil, lube oil, and treated water. However, the staff also noted that where environments are not controlled and may not be consistent over time, a single inspection may not be adequate to predict future degradation. By letter dated May 2, 2011, the staff issued RAI 3.3.2.2.7.3-1, noting that the GALL Report, Revision 2, recommends a periodic inspection program to manage this combination of material, environment, and aging effect and asking the applicant to provide justification that a one-time inspection provides adequate aging management for the associated components.

In its response dated June 3, 2011, the applicant stated that it committed (Commitment No. 40) to implement a new plant-specific program, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, and referred to its letter dated May 24, 2011, for the related response to RAI 3.3.2.71-2. The applicant stated that this program consists of inspections of the internal surfaces of aluminum, copper alloy, stainless steel, and steel components exposed to air, condensation, diesel exhaust, or moist air, and external cooling coil surfaces. The applicant further stated that this is a periodic inspection program, including opportunistic inspections when components are opened for maintenance, repair, or surveillance, that will confirm that existing environmental conditions are not causing material degradation that could result in a loss of component intended function during the period of extended operation. For all AMR items associated with LRA Table 3.3.1, item 3.3.1-18, where the LRA originally credited the One-Time Inspection Program to manage loss of material, the applicant revised the LRA to state that loss of material will be managed by its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff finds the applicant's response acceptable because the applicant replaced the originally proposed one-time inspection of LRA Table 3.3.1, item 3.3.1-18, components with a periodic inspection program. The staff's concerns described in RAI 3.3.2.2.7.3-1 are resolved.

The staff's evaluation of the applicant's plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds that the applicant met the further evaluation criteria. The staff also finds that the applicant's specified program is acceptable to manage loss of material due to general (steel only), pitting, and crevice corrosion of steel and stainless steel piping, piping components, and piping elements exposed to diesel exhaust because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes the following:

- visual inspections, which are capable of detecting loss of material due to general, pitting, and crevice corrosion of steel and stainless steel components exposed to diesel exhaust
- periodic inspections, which provide for ongoing opportunities to detect the aging effect if it should occur
- requirements for implementing corrective actions if unacceptable indications of aging is found

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.7.3 criteria. For those items that apply to LRA Section 3.3.2.2.7.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7 criteria. For those AMR items that apply to LRA Section 3.3.2.2.7, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Section 3.3.2.2.8, associated with LRA Table 3.3.1, item 3.3.1-19, addresses steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil, which are being managed for loss of material due to general, pitting, and crevice corrosion and MIC by the Buried Piping and Tanks Inspection Program. The criteria in SRP-LR Section 3.3.2.2.8 states that loss of material due to general, pitting, and crevice corrosion and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil. The SRP-LR also states that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Buried Piping and Tanks Inspection Program is a combination of a mitigation program, consisting of protective coatings, and a condition monitoring program, consisting of visual inspections, to manage loss of material for steel piping.

The staff's evaluation of the applicant's Buried Piping and Tanks Inspection Program is documented in SER Section 3.0.3.2.3. The staff noted that LRA Section B.2.7, "Buried Piping and Tanks Inspection Program," states that degradation or leakage found during inspections is entered into the Corrective Action Program to ensure that evaluations are performed and appropriate corrective actions are taken. The staff also noted that in the response to RAI B.2.7-1, questions 3 and 4, as documented in SER Section 3.0.3.2.3, the plant-specific specifications for backfill are sufficient to not cause damage to buried piping or its coatings, and the quality of backfill will be confirmed during excavated direct visual inspections as recommended by GALL Report, Revision 2, AMP XI.M41, "Buried and Underground Piping and Tanks." Cathodic protection is provided for the buried in-scope EDG fuel oil piping, the applicant committed (Commitment No.3) to install cathodic protection on the buried in-scope service water piping and EDG fuel oil storage tanks prior to the period of extended operation.

In its review of components associated with item 3.3.1-19, the staff finds that the applicant met the further evaluation criteria. The staff also finds the applicant's proposal to manage aging using the Buried Piping and Tanks Inspection Program acceptable because the program includes (1) standard industry preventive actions such as protective coatings, quality backfill, and cathodic protection, periodic visual inspections starting 10 years prior to the period of extended operation, and (2) incorporation of plant-specific operating experience through the Corrective Action Program.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.8 criteria. For those items that apply to LRA Section 3.3.2.2.8, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain 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, Microbiologically-Influenced Corrosion and Fouling

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9:

(1) LRA Section 3.3.2.2.9.1, associated with LRA Table 3.3.1, item 3.3.1-20, addresses steel piping, piping components, piping elements, and tanks exposed to fuel oil, which are being managed for loss of material due to pitting and crevice corrosion by the Fuel Oil Chemistry and One-Time Inspection Programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will be used to verify the effectiveness of the Fuel Oil Chemistry Program to manage the loss of material through examination of susceptible locations in steel piping, piping components, piping elements, and tanks exposed to fuel oil in the fuel oil system.

The staff reviewed LRA Section 3.3.2.2.9.1 against the criteria in SRP-LR Section 3.3.2.2.9, item 1, which state 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 staff evaluation of the applicant's Fuel Oil Chemistry and One-Time Inspection Programs is documented in SER Sections 3.0.3.2.9 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-20, the staff finds the applicant's proposal to manage aging using the One-Time Inspection Program to verify the effectiveness of the Fuel Oil Chemistry Program acceptable because the Fuel Oil Chemistry Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to examine steel piping, piping components, piping elements and tanks exposed to fuel oil to verify the effectiveness of the Fuel Oil Chemistry Program. This satisfies the acceptance criteria in SRP-LR Section 3.3.2.2.9, item 1; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9.1, criteria. For the AMR items that apply to LRA Section 3.3.2.2.9.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.9.2, associated with LRA Table 3.3.1, item 3.3.1-21, addresses loss of material in steel heat exchanger components in the auxiliary systems, due to general, pitting, crevice, MIC, and fouling, that are exposed to lubricating oil, which is managed by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, crevice, MIC, and fouling through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.3.2.2.9.2 against the criteria in SRP-LR Section 3.3.2.2.9, item 2, which states loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel heat exchanger components exposed to lubricating oil.

The staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11 respectively. In its review of components associated with item 3.3.1-21, the staff finds the applicant's proposal to manage aging using the One-Time Inspection Program and the Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.3.2.2.9, item 2; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9.2, criteria. For the AMR items that apply to LRA Section 3.3.2.2.9.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those AMR items that apply to LRA Section 3.3.2.2.9, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain 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 3.3.2.2.10.1, associated with LRA Table 3.3.1, item 3.3.1-22, addresses loss of material due to pitting and crevice corrosion in steel piping with elastomer lining or stainless steel cladding exposed to treated water or treated borated water if the cladding or lining is degraded. The applicant stated that this AMR item is not applicable because elastomer linings are not credited for protection of metallic components. The applicant further stated that the base metals are evaluated for aging as if exposed to the fluid environment, and elastomer linings, if present, do not perform an intended function. Therefore, the applicant concluded that no elastomer linings are identified as requiring AMR. The applicant also stated that auxiliary systems do not contain steel piping with stainless steel cladding that is exposed to treated water or treated borated water and subject to an AMR.

The staff noted that SRP-LR, Revision 2, Table 3.3-1, item 26, addressing steel (with elastomer lining), steel (with elastomer lining or stainless steel cladding) piping, piping components, and piping elements exposed to treated water recommends that GALL Report AMPs XI.M2, "Water Chemistry," and XI.M32, "One-Time Inspection" be used to manage loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation). The staff also noted that, based on a review of LRA Section 3.3, wherever the applicant identified steel piping or piping components exposed to treated water, its One-Time Inspection and PWR Water Chemistry Programs was used to manage the aging effect of loss of material. The staff finds the applicant's statement that item 3.3.1-22 is not applicable acceptable because the applicant is managing the aging of these components consistent with SRP-LR, Revision 2.

The staff reviewed LRA Sections 2.3.3 and 3.3 and the USAR and confirmed that no in-scope steel piping with elastomer lining exposed to treated borated water are present in the SFP cooling system; therefore, it finds the applicant's claim acceptable.

(2) LRA Section 3.3.2.2.10.2, associated with LRA Table 3.3.1, items 3.3.1-23 and 3.3.1-24, addresses stainless steel and aluminum piping, piping components, and piping elements and stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water, which are being managed for loss of material due to pitting and crevice corrosion by the PWR Water Chemistry Program and One-Time Inspection Program. The staff noted that the applicant also applied item 3.3.1-24 to stainless steel tanks. The criteria in SRP-LR Section 3.3.2.2.10.2, states that loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, and piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The SRP-LR also states that the Water Chemistry Program relies on monitoring and control of water chemistry to mitigate degradation, and a one-time inspection of select 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 addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, piping elements, and tanks exposed to treated water will be managed by the PWR Water Chemistry Program and One-Time Inspection Program.

LRA Section 3.3.2.2.10.2, associated with LRA Table 3.3.1, item 3.3.1-23, addresses loss of material due to pitting and crevice corrosion in stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The applicant stated that this item is not applicable because this item is only applicable for BWRs and that the auxiliary systems do not contain stainless steel or steel with stainless steel cladding heat exchanger components. The staff reviewed LRA Sections 2.3.3 and 3.3 and the USAR and confirmed that the auxiliary systems do not contain stainless steel or steel with stainless steel cladding heat exchanger components; therefore, it finds the applicant's claim acceptable.

The applicant stated that for item 3.3.1-24, the applicability is limited to the stainless steel piping, piping components, piping elements, and tanks exposed to treated water. The staff noted that a search of the applicant's USAR confirmed that no in-scope aluminum piping, piping components, and piping elements exposed to treated water are present in the auxiliary system.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-24, the staff finds that the applicant met the further evaluation criteria and the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs acceptable. The Water Chemistry Program uses chemical sampling and corrective actions to ensure that impurities are minimized to reduce aging due to loss of material, and the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion, consistent with the recommendations in the GALL Report, Revision 2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.2, criteria. For those items that apply to LRA Section 3.3.2.2.10.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) LRA Section 3.3.2.2.10, associated with LRA Table 3.3.1, item 3.3.1-25, addresses copper-alloy HVAC piping, piping components, and piping elements exposed to condensation (external). These are being managed for loss of material due to pitting and crevice corrosion by the One-Time Inspection Program to manage the aging effect for copper-alloy heat exchanger components, the Bolting Integrity Program to manage the aging effect for copper-alloy bolting, and the External Surfaces Monitoring Program to manage the aging effect for copper-alloy piping, piping components, and piping elements. The criteria in SRP-LR Section 3.3.3.2.10.3, state that the loss of material due to pitting and crevice corrosion could occur for copper-alloy HVAC piping, piping components, and piping elements exposed to condensation and recommends further evaluation of a plant-specific AMP to manage the aging effects. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to pitting and crevice corrosion for copper-alloy piping, piping components, and piping elements exposed to condensation will be managed by the External Surfaces Monitoring Program, copper-alloy bolting exposed to a condensation will be managed by the Bolting Integrity Program, and copper-alloy heat exchanger components exposed to a condensation will be managed by the One-Time Inspection Program.

The staff's evaluations of the applicant's Bolting Integrity and External Surfaces Monitoring Programs are documented in SER Sections 3.0.3.2.2 and 3.0.3.2.5, respectively. The staff noted that the applicant's Bolting Integrity Program includes periodic inspections of bolt closures and connections for signs of degradation and preventive measures to minimize loss of preload and cracking. The staff also noted that the applicant's External Surfaces Monitoring Program includes periodic visual inspections and surveillance activities of component external surfaces. In its review of components associated with item 3.3.1-25, for which the applicant credited the Bolting Integrity or External Surfaces Monitoring Program to manage loss of material, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging is acceptable because the periodic visual inspections included in the applicant's Bolting Integrity and External Surfaces Monitoring Programs are capable of detecting loss of material prior to loss of component intended function.

The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the applicant's One-Time Inspection Program includes visual and physical examinations (including non-destructive examination techniques) based on the material and environment combination. However, the staff also noted that, consistent with the GALL Report, one-time inspections are appropriate for managing loss of material for components exposed to environments that are consistent with time, such as fuel oil, lubricating oil, and primary or secondary water, to verify the effectiveness of the programs that control these environments to within acceptable limits. Where environments may not be consistent with time and are not controlled within acceptable limits, such as indoor or outdoor air, the GALL Report recommends periodic inspections to manage aging since a single inspection may not reflect, or predict, the existence of future degradation. By letter dated April 20, 2011, the staff issued RAI 3.3.2.71-2 requesting that the applicant provide details on how aging will be managed for copper-alloy heat exchanger components, given that the One-Time Inspection Program may not be an effective program to manage aging for components exposed to inconsistent or corrosive environments.

In its response dated May 24, 2011, the applicant revised the LRA to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material for copper-alloy heat exchanger components exposed externally to condensation. The staff's evaluation of the applicant's Inspection of internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. In its review of components associated with item 3.3.1-25, for which the applicant credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material, the staff finds that the applicant met the further evaluation criteria. The staff also found that the applicant's proposal to manage aging is acceptable because the proposed program includes baseline and opportunistic visual inspections, which are capable of detecting loss of material prior to loss of component intended function. The staff's concern described for these components in RAI 3.3.2.71-2 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.3 criteria. For those items that apply to LRA Section 3.3.2.2.10.3, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(4) LRA Section 3.3.2.2.10.4 is associated with LRA Table 3.3.1, item 3.3.1-26, and addresses copper-alloy piping, piping components, and piping elements exposed to lubricating oil, which are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis and One-Time Inspection Programs. The applicant stated that this item is being applied to copper alloy with greater than 15 percent Zn piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program, which will manage loss of material due to pitting and crevice corrosion for copper-alloy components with greater than 15 percent Zn through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.3.2.2.10.4 against the criteria in SRP-LR Section 3.3.2.2.10, item 4, which states that loss of material due to pitting and crevice corrosion could occur for copper-alloy piping, piping components, and piping elements exposed to lubricating oil and noted that the applicant did not address how loss of material would be managed for copper-alloy components exposed to lubricating oil that do not have greater than 15 percent Zn. In LRA Tables 3.3.2-14, 3.3.2-18, 3.3.2-30, 3.4.2-1, and 3.4.2-4, the applicant referenced item 3.3.1-26 and generic note I for other types of copper alloy components exposed to fuel oil and stated that the components have no AERM. For these items, the applicant cited plant-specific notes that state that the components are made of copper alloy with less than 15 percent Zn and are not in contact with a more cathodic metal; therefore, the components have no AERM.

The staff evaluated the applicant’s claim and noted that copper alloy with less than 15 percent Zn components is less susceptible to loss of material than other copper alloys; however, the presence of contaminants (e.g., water) in lubricating oil can create an environment conducive to loss of material, regardless of whether or not the component is in contact with a more cathodic metal. The staff also noted that the criteria in SRP-LR Section 3.3.2.2.10, item 4, are for components constructed of all types of copper alloy, not just copper alloy with greater than 15 percent. It is unclear to the staff why the applicant claims that copper-alloy components with less than 15 percent Zn have no AERM. By letter dated September 22, 2011, the staff issued RAI 3.3.2.2.10.4-1 requesting that the applicant explain why copper-alloy components with less than 15 percent Zn components exposed to lubricating oil have no AERM or provide an appropriate AMP to manage loss of material.

In its response dated October 21, 2011, the applicant revised the LRA to identify loss of material as an AERM for copper alloy with less than 15 percent Zn components exposed to lubricating oil and to credit the Lubricating Oil Analysis and One-Time Inspection Programs to manage the aging effect. The applicant revised the AMR items that referenced item 3.3.1-26 and generic note I in LRA Tables 3.3.2-14, 3.3.2-18, 3.3.2-30, and 3.4.2-1 to reference generic notes A or C. The applicant revised the AMR items that referenced item 3.3.1-26 and generic note I in LRA Table 3.4.2-4 to instead reference item 3.4.1-18 and generic note C. The staff noted that item 3.4.1-18 is an acceptable alternative because it is for copper-alloy components exposed to lubricating oil which are being managed for loss of material using the Lubricating Oil Analysis and One-Time Inspection Programs. The staff finds the applicant’s response acceptable because the applicant has revised the LRA to manage loss of material for copper alloy with less than 15 percent Zn components exposed to lubricating oil as recommended by the SRP-LR. The staff’s concern described in RAI 3.3.2.2.10.4-1 is resolved.

The staff’s evaluation of the applicant’s Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of copper alloy with greater than 15 percent Zn components exposed to lubricating oil associated with item 3.3.1-26, the staff finds the applicant’s proposal to manage aging using the Lubricating Oil Analysis and One-Time Inspection Programs acceptable because the Lubricating Oil Analysis Program will monitor and control the presence of contaminants in the lubricating oil to preserve an environment that is not conducive to aging, and the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program, which satisfies the acceptance criteria in SRP-LR Section 3.3.2.2.10, item 4.

Based on the programs identified, the staff concludes that the applicant’s programs meet SRP-LR Section 3.3.2.2.10.4 criteria. For the AMR items that apply to LRA Section 3.3.2.2.10.4, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effect 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).

(5) LRA Section 3.3.2.2.10.5, associated with LRA Table 3.3.1, item 3.3.1-27, addresses stainless steel and aluminum components in auxiliary systems exposed to condensation,

which are being managed for loss of material due to pitting and crevice corrosion. The criteria in SRP-LR Section 3.3.2.2.10.5, state that loss of material due to pitting and crevice corrosion could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The SRP-LR also states that a plant-specific AMP should be evaluated to ensure that these aging effects are adequately managed. The applicant addressed the further evaluation criteria of the SRP-LR by identifying three AMPs to manage the aging effect as described below.

The applicant stated the following:

- The Bolting Integrity Program will be used to manage loss of material due to pitting and crevice corrosion of stainless steel bolting exposed to condensation (external) in the service water system.
- The External Surfaces Monitoring Program will be used to manage loss of material due to pitting and crevice corrosion for stainless steel piping, piping components, and piping elements exposed to external condensation in the auxiliary building chilled water system, the containment hydrogen control system, the service water system, and the station plumbing, drains, and sumps system.
- The One-Time Inspection Program will be used to detect and characterize loss of material due to pitting and crevice corrosion for stainless steel heat exchanger components exposed to external condensation in the auxiliary building HVAC system and for stainless piping, piping components, piping elements, and tanks (demisters, drain pans, and moisture separators) exposed to internal condensation in the containment air cooling and recirculation system, the containment hydrogen control system, and the process and area radiation monitoring system.

In its review of components associated with item 3.3.1-27, the staff noted that one-time inspections are appropriate for managing loss of material in environments that are controlled and consistent over time, such as fuel oil, lube oil, and treated water. However, where environments are not controlled and may not be consistent over time, a single inspection may not be adequate to predict future degradation. By letters dated April 20 and May 2, 2011, the staff issued RAIs 3.3.2.71-2 and 3.2.2.1.26-1, respectively, requesting the applicant to provide an alternative program for managing loss of material for metals in environments such as indoor air, outdoor air, and condensation that are not well controlled and may not be consistent over time or to justify that the One-Time Inspection Program provides adequate aging management for these material, environment, and aging effect combinations.

In its responses dated May 24 and June 3, 2011, respectively, the applicant stated that the LRA is revised to include a new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant stated that this program consists of inspections of the internal surfaces of aluminum, copper alloy, stainless steel, and steel components exposed to air, condensation, diesel exhaust, or moist air, and external cooling coil surfaces. The applicant further stated that this is a periodic inspection program, including opportunistic inspections when components are opened for maintenance, repair, or surveillance, that will confirm that existing environmental conditions are not causing material degradation that could result in a loss of component intended function during the period of extended operation. For all AMR items associated with LRA Table 3.3.1, item 3.3.1-27, where the LRA originally credited the One-Time Inspection Program to manage loss of material, the applicant revised the LRA to state that loss of material will be managed by its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff finds the applicant's response acceptable because the applicant replaced the originally proposed One-Time Inspection Program of LRA Table 3.3.1, item 3.3.1-27, components with a periodic inspection program. The staff's concerns described in RAIs 3.3.2.71-2 and 3.2.2.1.26-1 are resolved.

The staff's evaluations of the applicant's Bolting Integrity Program, External Surfaces Monitoring Program, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program are documented in SER Sections 3.0.3.2.2, 3.0.3.2.5, and 3.0.3.3.7 respectively. The staff noted that the Bolting Integrity Program, the External Surfaces Monitoring Program, and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program all use periodic visual inspections that are capable of detecting loss of material due to pitting and crevice corrosion in aluminum and stainless steel components and include provisions for implementing corrective action if unacceptable indications of loss of material due to these corrosion mechanisms are found. In its review of components associated with item 3.3.1-27, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the Bolting Integrity Program, the External Surfaces Monitoring Program, and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is acceptable for the following reasons:

- Each of the credited programs includes periodic visual inspections that are capable of detecting loss of material due to pitting and crevice corrosion in aluminum and stainless steel components.
- Periodic inspections provide ongoing opportunities to detect the aging effect if it should occur.
- Each credited program includes requirements for implementing corrective actions if unacceptable indications of loss of material due to pitting or crevice corrosion are found.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.5, criteria. For those items that apply to LRA Section 3.3.2.2.10.5, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(6) LRA Section 3.3.2.2.10.6, associated with LRA Table 3.3.1, item 3.3.1-28, addresses copper-alloy fire protection piping, piping components, and piping elements exposed to condensation (internal), which are being managed for loss of material due to pitting and crevice corrosion by the One-Time Inspection Program. The criteria in SRP-LR in SRP-LR Section 3.3.3.2.10.6, state that loss of material due to pitting and crevice corrosion could occur for copper-alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) and recommends further evaluation of a plant-specific AMP to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR by stating that while it does not have copper-alloy piping in the fire protection system, copper-alloy piping, piping components, and piping

elements exposed to internal condensation in other systems will be managed by the One-Time Inspection Program.

The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the applicant's One-Time Inspection Program proposes to manage loss of material of copper-alloy piping, piping components, and piping elements using a variety of non-destructive examination techniques based on the material and environment combination. However, the staff also noted that one-time inspections are appropriate for managing loss of material for components exposed to environments that are consistent with time, such as fuel oil, lubricating oil, and primary or secondary water, to verify the effectiveness of the programs that control these environments to within acceptable limits. Where environments may not be consistent with time and are not controlled within acceptable limits, such as indoor or outdoor air, the GALL Report recommends periodic inspections to manage aging since a single inspection may not reflect, or predict, the existence of future degradation. By letter dated April 20, 2011, the staff issued RAI 3.3.2.71-2 requesting that the applicant provide details on how aging will be managed for copper-alloy components exposed to condensation, given that the One-Time Inspection Program may not be an effective program to manage aging for components exposed to inconsistent or corrosive environments.

In its response dated May 24, 2011, the applicant revised the LRA to credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material due to pitting and crevice corrosion for copper-alloy piping, piping components, and piping elements exposed internally to condensation. The staff's evaluation of the applicant's Inspection of internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. In its review of components associated with item 3.3.1-28, for which the applicant credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging is acceptable because the proposed program includes baseline and opportunistic visual inspections, which are capable of detecting loss of material prior to loss of component intended function. The staff's concern described for these components in RAI 3.3.2.71-2 is resolved.

Based on the program identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.6 criteria. For those items that apply to LRA Section 3.3.2.2.10.6, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(7) LRA Section 3.3.2.2.10.7, associated with LRA Table 3.3.1, item 3.3.1-29, addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to soil. The applicant stated that this item is not applicable because there are no stainless steel piping, piping components, or piping elements in the auxiliary systems that are exposed to soil. The staff reviewed LRA Sections 2.3.3 and 3.3 and the applicant's USAR and confirmed that no in-scope stainless steel piping, piping components, and piping elements exposed to soil are present in the auxiliary systems; therefore, it finds the applicant's claim acceptable.

(8) LRA Section 3.3.2.2.10.8, associated with LRA Table 3.3.1, item 3.3.1-30, addresses stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution, which are being managed for loss of material due to pitting and crevice corrosion. The applicant stated that this item is not applicable because loss of material for these BWR components is only applicable to BWR plants. The staff noted that this item is associated only with BWRs; therefore, it finds the applicant's claim acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

LRA Section 3.3.2.2.11, associated with LRA Table 3.3.1, item 3.3.1-31, addresses loss of material due to pitting, crevice, and galvanic corrosion for copper-alloy piping, piping components, and piping elements exposed to treated water. The applicant stated that this item is not applicable because there are no copper-alloy piping, piping components, or piping elements in the auxiliary systems that are exposed to treated water. The staff reviewed LRA Sections 2.3.3 and 3.3 and the USAR and confirmed that no in-scope copper-alloy piping, piping components, and piping elements exposed to treated water are present in the auxiliary systems; therefore, it finds the applicant's claim acceptable.

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.12 against the criteria in SRP-LR Section 3.3.2.2.12:

(1) LRA Section 3.3.2.2.12.1, associated with LRA Table 3.3.1, item 3.3.1-32, addresses stainless steel, aluminum and copper-alloy piping, piping components, and piping elements exposed to fuel oil, which are being managed for loss of material due to pitting, crevice, and MIC by the Fuel Oil Chemistry and One-Time Inspection Programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will be used to verify the effectiveness of the Fuel Oil Chemistry Program to manage the loss of material through examination of susceptible locations in stainless steel and copper-alloy piping, piping components, and piping elements exposed to fuel oil.

The staff reviewed LRA Section 3.3.2.2.12.1 against the criteria in SRP-LR Section 3.3.2.2.12.1, which states 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.

The staff's evaluations of the applicant's Fuel Oil Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.9 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-32, the staff finds the applicant's proposal to manage aging using the One-Time Inspection Program to verify the effectiveness of the Fuel Oil Chemistry Program acceptable because the Fuel Oil Chemistry Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to examine stainless steel, aluminum and copper-alloy piping, piping components, and piping elements to verify the effectiveness of the Fuel Oil Chemistry Program. This satisfies the acceptance criteria in SRP-LR Section 3.3.2.2.12.1; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12.1, criteria. For the items that apply to LRA Section 3.3.2.2.12.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.12.2, associated with Table 3.3.1, item 3.3.1-33, addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil, which are being managed for loss of material due to pitting, crevice, and MIC by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to pitting, crevice, and MIC through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.3.2.2.12.2 against the criteria in SRP-LR Section 3.3.2.2.12.2, which state 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 staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.3.1-33, the staff finds the applicant's proposal to manage aging using the One-Time Inspection and Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.3.2.2.12.2; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12.2, criteria. For the AMR items that apply to LRA Section 3.3.2.2.12.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.13 Loss of Material Due to Wear

LRA Section 3.3.2.2.13, associated with LRA Table 3.3.1 item 3.3.1-34, addresses elastomer seals and components exposed to air-indoor uncontrolled (internal or external) with an aging effect of loss of material due to wear. The criteria in SRP-LR Section 3.3.2.2.13 states that loss of material due to wear could occur in the elastomer seals and components exposed to air-indoor uncontrolled (internal or external). The SRP-LR also states that the GALL Report recommends further evaluation of a program to ensure that the aging effects are adequately managed. The applicant addressed the further evaluation criteria of the SRP-LR by stating that wear of elastomer seals and components exposed to air is not identified as an AERM at Davis-Besse and that loss of material due to wear is the result of relative motion between two surfaces in contact. The applicant further stated that wear occurs during the performance of an active function as a result of improper design, application, or operation or to a very small degree with insignificant consequences. Therefore, the applicant concluded that loss of material due to wear is not an AERM for elastomers exposed to air-indoor uncontrolled.

The staff noted that the applicant based its conclusion—that loss of material due to wear was not an AERM—on the fact that wear is an active loss of material mechanism and not on the fact that the elastomeric HVAC seals and components, for which wear is plausible, are active components or components that are replaced on a qualified or specified frequency. The staff noted that within the definition of the term “wear” in GALL Report Section IX.F, there are three factors to consider that could cause age-related wear due to the design of the joint—relative motion between two surfaces (under the influence of hard abrasive particles), frequent manipulation, or in clamped joints where relative motion is not intended but may occur due to a loss of the clamping force. It is unclear to the staff whether there are any in-scope components that are designed in such a way that they could be impacted by the three age-related factors considered in the definition of wear. By letter dated May 2, 2011, the staff issued RAI 3.3.2.2.13-1 requesting that the applicant state whether there any in-scope elastomeric components designed with relative motion that are exposed to an internal or external environment that includes hard abrasive particles, are susceptible to wear over time due to their frequent manipulation, or have clamped joints where relative motion is not intended but may occur due to a loss of the clamping force over time causing wear that could challenge the CLB function(s) of the component. The RAI also asked, if an AERM is applicable based on the configurations or aging mechanisms described above, that the applicant discuss how the AERM will be managed.

In its response dated June 3, 2011, the applicant stated the following:

- In regard to wear by hard abrasive particles, the fuel oil and lubricating oil quality is maintained by managing particulates and other contaminants. In-scope elastomeric components that are exposed to the air, raw water and treated water environments are within systems in which the medium is not expected to contain hard abrasive particles sufficient to cause loss of material due to wear.
- In-scope elastomeric components are not expected to be manipulated at a frequency sufficient to cause loss of material due to wear.
- In-scope elastomeric components are not expected to have relative motion due to a loss of clamping force that is sufficient to cause loss of material due to wear. However, the applicant revised the LRA to include loss of material due to wear as an aging effect for elastomeric components.

The applicant revised LRA Section 3.3.2.2.13 to state that loss of material due to wear of elastomeric components exposed to air-indoor uncontrolled (internal and external) will be managed by the plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program internally and the External Surfaces Monitoring Program externally. The applicant also revised LRA Tables 3.3.2-1, 3.3.2-6, 3.3.2-12, 3.3.2-13, 3.3.2-14, 3.3.2-15, 3.3.2-21, 3.3.2-28, and 3.3.2-30 to add new AMR lines for elastomeric components in air-indoor uncontrolled internal and external environments with an aging effect of loss of material.

The staff's evaluations of the applicant's External Surface Monitoring and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Programs are documented in SER Sections 3.0.3.2.5 and 3.0.3.3.7 respectively. In its review of components associated with item 3.3.1-34 and the applicant's response to RAI 3.3.2.2.13-1, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the External Surfaces Monitoring and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Programs is acceptable for the following reasons:

- Because there are no abrasive particles that could cause wear, the only aging mechanisms that could generate wear would be equally impactful on the interior and exterior surfaces of the in-scope component.
- The "scope of program" program element of GALL Report (Revision 2) AMP XI.M36 allows the use of AMP XI.M36 for managing internal aging effects for polymeric (elastomers are a subset of polymers) components as long as material and environment combinations are the same for the internal and external surfaces. For this material and environment combination, the internal and external environments are the same.
- The External Surfaces Monitoring Program conducts periodic visual inspections accompanied by physical manipulation of the elastomeric material that are capable of detecting wear in elastomeric components.
- The applicant is supplementing the External Surface Monitoring Program with its new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program.
- The applicant added new AMR items in LRA Section 3.3, Table 2s, where applicable, for this material/environment/aging effect combination and credited the Inspection of Internal Surface in Miscellaneous Piping and Ducting Program.
- The new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes visual and physical (manipulation or prodding) examination of subject non-metallic, flexible (elastomeric) components in various environments for evidence of loss of material due to wear.

The staff's concern described in RAI 3.3.2.2.13-1 is resolved.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.13 criteria. For those AMR items that apply to LRA Section 3.3.2.2.13, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.14 Loss of Material Due to Cladding Breach

LRA Section 3.3.2.2.14, associated with LRA Table 3.3.1, item 3.3.1-35, addresses steel with stainless steel cladding pump casings exposed to treated borated water, which are being managed for loss of material due to cladding breach. The GALL Report recommends further evaluation by a plant-specific AMP to ensure that the aging effect is adequately managed. The applicant stated that this item is not applicable because the auxiliary systems do not contain steel pump casings with stainless steel cladding that are exposed to treated borated water and subject to an AMR. The staff reviewed LRA Sections 2.3.3 and 3.3 and the USAR and confirmed that no in-scope steel with stainless steel cladding pump casing exposed to treated borated water are present in the auxiliary system; therefore, it finds the applicant's claim acceptable.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.3.2-1 through 3.3.2-32, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-32, the applicant indicated, via notes F–J, that the combination of component type, material, environment, and AERM does not correspond to an AMR item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the AMR item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the AMR 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 if the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.3.2.3.1 Auxiliary Systems—Auxiliary Building HVAC System—Aging Management Review Results—LRA Table 3.3.2-1

In LRA Tables 3.3.2-1 and 3.3.2-30, the applicant stated that the copper-alloy heat exchanger cooling coil tubes and aluminum heat exchanger cooling fins exposed to air-outdoor (external) are being managed for reduction in heat transfer by the External Surfaces Monitoring Program. The AMR items cite generic note G or H.

The staff reviewed the associated items in the LRA and considered whether the applicant identified all of the credible aging effects for this component, material, and environment combination. The staff noted that even though Revision 1 of the GALL Report did not address copper-alloy or aluminum components exposed to outdoor air, Revision 2 of the GALL Report states that these components are subject to loss of material due to pitting and crevice corrosion. The GALL Report also states, in Table IX.E, that heat exchangers are susceptible to loss of heat transfer. The staff also noted that the applicant addressed loss of material for the copper-alloy components in other AMR items in LRA Tables 3.3.2-1 and 3.3.2-30. The applicant did not include loss of material as an aging effect for the aluminum cooling fins. However, the staff noted that the cooling fins only have a heat transfer function, and any loss of material of the fins would be considered reduction of heat transfer. Therefore, management of reduction of heat transfer by the External Surfaces Monitoring Program would be the same as for loss of material. Based on its review of the LRA and of the GALL Report, Revision 2, the staff finds the applicant identified all credible aging effects for the copper-alloy components and that the inspections for reduction of heat transfer are adequate to manage any potential loss of material for the aluminum cooling fins.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring Program acceptable because the visual inspections and surveillance activities included in the AMP are adequate to identify evidence of reduction of heat transfer, such as build-up of dirt and other foreign material, in the copper-alloy heat exchanger cooling coil tubes and aluminum heat exchanger cooling fins exposed to air-outdoor (external) prior to loss of heat transfer function.

In LRA Tables 3.3.2-1, 3.3.2-12, 3.3.2-14, 3.3.2-15, 3.3.2-26, and 3.3.2-30, the applicant stated that the steel bolting exposed to air-outdoor (external) is being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note H.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because GALL Report AMP XI.M18, "Bolting Integrity," indicates that a loss of preload is an aging effect that is monitored for bolting materials. Steel materials are also susceptible to loss of material, which is addressed in another AMR item. Thus, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts, which verifies that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-1, the applicant stated that the copper-alloy heat exchanger tubes, containing more than 15 percent Zn, exposed to raw water are being managed for cracking by the Open-Cycle Cooling Water Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, items VII.C1-3 and VII.C1-6, which address copper-alloy heat exchanger components exposed to raw water and recommend the Open-Cycle Cooling Water Program to manage loss of material due to various corrosion mechanisms and fouling and reduction in heat transfer. However, the staff noted that the applicant had not identified the additional aging effect in the GALL Report, item VII.C1-4, for selective leaching of copper-alloy heat exchanger components in a raw water environment. By letter dated May 2, 2011, the staff issued RAI 3.3.2.1-1 requesting that the applicant provide justification for not identifying selective leaching as an applicable aging effect for copper-alloy heat exchanger tubes.

In its response dated June 3, 2011, the applicant stated that the aging management of the copper-alloy heat exchanger is consistent with the GALL Report. The applicant stated that the copper-alloy heat exchanger tubes exposed to raw water are made of admiralty brass, which is an inhibited copper alloy. The applicant stated that copper alloys with greater than 15 percent Zn are susceptible to selective leaching with the exception of inhibited brass. The staff finds the applicant’s response acceptable because, per GALL report Table IX.C, copper-alloy components with greater than 15 percent Zn are susceptible to selective leaching except for inhibited brass, which includes admiralty brass. The staff’s concern described in RAI 3.3.2.1-1 is resolved.

The staff’s evaluation of the applicant’s Open-Cycle Cooling Water Program is documented in SER Section 3.0.3.2.12. The staff notes that the acceptability of the applicant’s program to manage cracking of copper-alloy heat exchanger components with this AMP was clarified through RAI B.2.31-1 and is documented in SER Section 3.0.3.2.12. The staff finds the applicant’s proposal to manage aging using the Open-Cycle Cooling Water Program acceptable because the program includes periodic visual inspections, which are adequate to detect and manage the aging effects, consistent with the guidance in the GALL Report.

In LRA Tables 3.3.2-1 and 3.3.2-13, the applicant stated that for glass filter housings exposed to air with borated water leakage (external), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G. The staff reviewed the associated items in the LRA and confirmed that no aging effect is applicable for this component, material, and environmental combination because the GALL Report, item V.F-9, states that for an environment of treated borated water, there is no AERM and no recommended AMP, and the air with borated water leakage environment is no more severe than the treated borated water environment for this material.

In LRA Tables 3.3.2-1, 3.3.2-12, 3.3.2-14, and 3.3.2-30, the applicant stated that copper alloy and copper alloy with greater than 15 percent Zn heat exchanger tubes, piping, tubing, valve bodies, and spray nozzles exposed internally or externally to outdoor air have no AERMs, and no AMP is proposed. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that loss of material could occur in copper-alloy components exposed internally or externally (or both) to outdoor air, depending on atmospheric contaminants in the environment. The GALL Report states that condensation on the surfaces of systems at temperatures below the dew point is considered “raw water” due to the potential for internal or external surface contamination. The GALL Report further states that copper alloys (except for inhibited brass) that contain greater than 15 percent Zn exposed to a raw water environment may be susceptible to selective leaching and cracking. By letter dated May 2, 2011, the staff issued RAI 3.3.2-2 requesting that the applicant state why the specific environment—air-outdoor (external or internal or both)—will not induce cracking, selective leaching, or loss of material in copper alloy or copper alloy with greater than 15 percent Zn component.

In its response dated June 3, 2011, the applicant stated the following:

(a) The aftercooler tubes in the EDG (LRA Table 3.3.2-12) and SBODG systems (LRA Table 3.3.2-30) are exposed to outdoor air, which is ducted and filtered such that it does not contain water or rain; therefore, the components are not susceptible to loss of material or cracking.

(b) The outdoor air (internal) environment used in the fire protection system (LRA Table 3.3.2-14) is not a wetted environment because it is for sprinkler system components that are normally drained but are vented to the atmosphere in which the components are located; therefore, the components are not susceptible to loss of material or cracking.

(c) Loss of material due to pitting and crevice corrosion could not be ruled out for the remaining copper-alloy components exposed externally to outdoor air.

(d) Cracking and selective leaching could not be ruled out for the copper alloy with greater than 15 percent Zn components exposed externally to outdoor air.

The applicant revised the LRA to credit the External Surfaces Monitoring Program to manage loss of material for copper-alloy components exposed externally to outdoor air and to manage cracking for copper alloy with greater than 15 percent Zn components exposed externally to outdoor air. The applicant also revised the LRA to credit the Selective Leaching of Materials Program to manage loss of material due to selective leaching for the copper alloy with greater than 15 percent Zn components exposed externally to outdoor air.

The staff evaluated the applicant's claim in part (a) above and noted that the GALL Report, Revision 2, has no recommendations for copper-alloy components exposed internally to outdoor air. However, item VII.J.AP-144 states that copper-alloy components exposed internally to indoor uncontrolled air have no AERM. The staff also noted that cracking and selective leaching are only applicable aging effects for copper alloy with greater than 15 percent Zn components when there is a potential for moisture accumulation or in the presence of contaminants. The staff finds the applicant's response to part (a) acceptable because the air in the aftercoolers is ducted and filtered, which prevents moisture and contaminants from accumulating on the tubes resulting in an environment similar to uncontrolled indoor air; therefore, these components are not susceptible to loss of material or cracking.

The staff evaluated the applicant's claim in parts (c) and (d) above and noted that the GALL Report, Revision 2, item VII.I.AP-159, states that copper-alloy components exposed externally to outdoor air are susceptible to loss of material and recommends GALL Report AMP XI.M36, "External Surfaces Monitoring," to manage aging. The staff's evaluations of the applicant's External Surfaces Monitoring and Selective Leaching Inspection Programs are documents in SER Sections 3.0.3.2.5 and 3.0.3.1.16, respectively. The staff also noted that the External Surfaces Monitoring Program includes visual inspections of metallic components for loss of material and cracking. The staff further noted that the Selective Leaching Inspection Program includes visual inspections and mechanical examinations to identify loss of material due to selective leaching. The staff finds the applicant's response in parts (c) and (d) above, and its proposal to manage aging using the External Surfaces Monitoring and Selective Leaching Inspection Programs, acceptable because the applicant is managing all of the credible aging effects for these material and environment combinations using programs that include inspection activities that are capable of detecting loss of material, selective leaching and cracking, consistent with the methods discussed in the GALL Report for managing these aging effects.

The staff evaluated the applicant's claim in part (b) above—that the fire protection system components exposed to outdoor air have no AERM—and noted that while the sprinkler system internal components are not directly exposed to a wetted environment, they are open to the atmosphere, which contains moisture that can potentially become trapped in the system and cause condensation to accumulate. The GALL Report, Revision 2, item VII.I.AP-159, states that copper-alloy components exposed externally to outdoor air are susceptible to loss of material. The staff also noted that there are no GALL Report recommendations for copper-alloy components exposed internally to outdoor air or condensation, but that a condensation environment can be bounded by a raw water environment. The GALL Report, Revision 2, item VII.G.AP-159, states that copper-alloy fire protection components exposed to raw water are susceptible to loss of material and recommends GALL Report AMP XI.M27, "Fire Water System," to manage the aging effect. The GALL Report, Section IX.C, states that copper alloy with greater than 15 percent Zn components is susceptible to selective leaching and cracking in addition to the aging effects for copper-alloy components. By letter dated July 27, 2011, the staff issued RAI 3.3.2-4 requesting that the applicant state why the copper-alloy components exposed to outdoor air are not susceptible to loss of material and the copper alloy with greater than 15 percent Zn components are not susceptible to cracking and selective leaching or provide an appropriate program to manage the aging effects.

In its response dated August 26, 2011, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program will be used to manage cracking and loss of material for copper alloy with greater than 15 percent Zn components and loss of material for the copper-alloy components exposed to air-outdoor (internal) in the fire protection system. The applicant also stated that the Selective Leaching Inspection will be used to manage loss of material due to selective leaching for copper alloy with greater than 15 percent Zn components exposed to air-outdoor (internal) in the fire protection system. The staff's evaluations of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program and Selective Leaching Inspection are documented in SER Sections 3.0.3.3.7 and 3.0.3.1.16, respectively. The staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes visual inspections of metallic components for loss of material and cracking. The staff also noted that the Selective Leaching Inspection Program includes visual inspections and mechanical examinations to identify loss of material due to selective leaching. The staff finds the applicants response, and its proposal to manage loss of material and cracking using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program and to manage loss of material due to selective leaching using the Selective Leaching Inspection, acceptable because the applicant is managing all of the credible aging effects for these material and environment combinations using programs that include inspection activities that are capable of detecting loss of material, selective leaching, and cracking, consistent with the GALL Report recommendations for managing these aging effects. The staff's concerns described in RAIs 3.3.2-2 and 3.3.2-4 are resolved.

During the staff's review of the applicant's response to RAI 3.3.2-4 in letter dated August 26, 2011, the staff noted that the applicant replaced LRA Table 3.3.2-14 in its entirety when incorporating the changes to the table discussed above. The staff also noted that a large portion of the table associated with the fire pump diesel engine components was missing and there was no explanation in the response for why the components would have been removed from the LRA. The staff discussed this issue with the applicant during a teleconference held September 7, 2011. During the teleconference the applicant stated that the fire pump diesel engine components were inadvertently removed from LRA Table 3.3.2-14 in the August 26, 2011 letter. By letter dated September 16, 2011, the applicant replaced LRA Table 3.3.2-14 in its entirety to include all of the fire protection system and fire pump diesel engine components. The staff reviewed the applicant's September 16, 2011, letter and confirmed that LRA Table 3.3.2-14, as amended, is complete.

In LRA Table 3.3.2-1, the applicant stated that the aluminum, copper alloy, and stainless steel heat exchanger components exposed externally to condensation are being managed for reduction in heat transfer by the One-Time Inspection Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, items 3.2.1-8, 3.3.1-25, 3.3.1-27, which address stainless steel, aluminum, and copper piping, piping components, and piping elements exposed to condensation and recommends a plant-specific program to manage loss of material; however, the applicant identified this additional aging effect. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-1.

The staff believes a periodic inspection program is recommended in this condensate environment where the conditions would be inconsistent over time. However, in LRA Table 3.3.2-1, the applicant instead proposed to use its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that it revised the LRA to manage this aging effect by the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program as part of its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response, and its proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because equipment must be disassembled to gain access to the external surfaces of the cooling coils, and the program includes visual periodic opportunistic inspections, which are capable of managing reduction of heat transfer through the period of extended operation. The staff's concern described above is resolved.

In LRA Tables 3.3.2-1 and 3.3.2-8, the applicant stated that the copper alloy and stainless steel heat exchanger components exposed to air-indoor uncontrolled (internal and external) are being managed for reduction in heat transfer by the One-Time Inspection Program. The AMR items cite generic note H or G.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because the GALL Report, Table IX.B, states that heat exchanger components are susceptible to reduction of heat transfer due to fouling.

In LRA Table 3.3.2-1, the applicant proposed to use its One-Time Inspection Program to manage reduction of heat transfer due to fouling. The staff's evaluation of the applicants' One-Time Inspection Program is documented in SER Section 3.0.3.2.11. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that it revised its LRA to manage this aging effect by the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program as part of its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response, and its proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because equipment must be disassembled to gain access to the external surfaces of the heat exchanger components, and the program includes visual periodic opportunistic inspections, which are capable of managing reduction of heat transfer through the period of extended operation. The staff's concern described above is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.2 Auxiliary Systems—Auxiliary Building Chilled Water System—Aging Management Review Results—LRA Table 3.3.2-2

In LRA Table 3.3.2-2, the applicant stated that the copper-alloy bolting exposed to condensation (external) is being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Report AMP XI.M18, "Bolting Integrity," indicates that a loss of preload is an aging effect that is monitored for bolting materials. Furthermore, the loss of material aging effect is addressed in another AMR item. Thus, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload and inspects for leakage and loose or missing nuts to verify that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

In LRA Tables 3.3.2-2, 3.3.2-8, and 3.3.2-26, the applicant stated that the steel bolting exposed to condensation (external) is being managed for loss of preload and cracking by the Bolting Integrity Program. The AMR items cite generic note H.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Report AMP XI.M18, "Bolting Integrity," indicates that a loss of preload and cracking are aging effects that are monitored for bolting materials. Thus, the aging effects of concern are loss of preload and cracking, which are addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts to verify that the aging effects, loss of preload and cracking, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

In LRA Tables 3.3.2-2, 3.3.2-26, 3.3.2-29, and 3.3.2-31, the applicant stated that the gray cast iron and copper-alloy (greater than 15 percent Zn) components exposed to condensation (external or internal) are being managed for loss of material by the Selective Leaching Inspection Program. The AMR items cite generic note G or H. The AMR item associated with copper-alloy (greater than 15 percent Zn) tubing in Table 3.3.2-29 also cites plant-specific note 0320, which states that the Selective Leaching Inspection Program will confirm the absence of selective leaching of copper-alloy (greater than 15 percent Zn) tubing for station air drainage components from periodic exposure to condensation.

The staff reviewed the associated AMR items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that even though gray cast iron and copper-alloy (greater than 15 percent Zn) components exposed to condensation are not specifically addressed in the GALL Report, GALL Report Table IX.C states that copper alloys (greater than 15 percent Zn) are susceptible to SCC and loss of material due to selective leaching and pitting and crevice corrosion, and gray cast iron is susceptible to loss of material due to selective leaching. The staff also noted that the applicant addressed loss of material due to other mechanisms for copper alloy (greater than 15 percent Zn) and gray cast iron components, and cracking for copper-alloy (greater than 15 percent Zn) components in other AMR items in LRA Tables 3.3.2-2, 3.3.2-26, 3.3.2-29, and 3.3.2-31. Based on its review of the GALL Report Table IX.C and the LRA, the staff finds that the applicant identified all of the credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Selective Leaching Inspection Program is documented in SER Section 3.0.3.1.16. The staff noted that the applicant's Selective Leaching Inspection Program will characterize the internal and external surface conditions of components made of gray cast iron and copper alloy (greater than 15 percent Zn) that may be susceptible to selective leaching and assess their ability to perform the intended functions during the period of extended operation. The staff finds the applicant's proposal to manage aging using the Selective Leaching Inspection Program acceptable because the proposed program includes visual inspections and mechanical examination techniques that can determine whether loss of material due to selective leaching is occurring.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.3 Auxiliary Systems—Auxiliary Steam and Station Heating Systems—Aging Management Review Results—LRA Table 3.3.2-3

In LRA Table 3.3.2-3, the applicant stated that the copper-alloy bolting exposed to air-indoor (external) is being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because

GALL Report AMP XI.M18, "Bolting Integrity," indicates that a loss of preload is an aging effect that is monitored for bolting materials. Furthermore, GALL Table IX.C states that copper alloys containing less than 15 percent Zn are resistant to SCC and loss of material due to selective leaching, pitting, and crevice corrosion. Thus, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts to verify that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

In LRA Table 3.3.2-3, the applicant stated that the gray cast iron valve body exposed to steam (internal) is being managed for loss of material by the Selective Leaching Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated AMR item in the LRA and considered whether the aging effects proposed by the applicant include all the credible aging effects for this component, material, and environment combination. The staff noted that even though gray cast iron exposed to steam is not specifically addressed in the GALL Report, GALL Report Table IX.C states that gray cast iron is susceptible to the same aging effects as steel (which include loss of material due to general, pitting, crevice, and flow-accelerated corrosion when exposed to steam) as well as loss of material due to selective leaching. The staff also noted that the applicant addressed loss of material due to other mechanisms for these gray cast iron components in other AMR items in LRA Table 3.3.2-2. Based on its review of the GALL Report Table IX.C and the LRA, the staff finds that the applicant identified all of the credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Selective Leaching Inspection Program is documented in SER Section 3.0.3.2.16. The staff noted that the applicant's Selective Leaching Inspection Program will characterize the internal and external surface conditions of components that may be susceptible to selective leaching and assess their ability to perform the intended functions during the period of extended operation. The staff finds the applicant's proposal to manage aging using the Selective Leaching Inspection Program acceptable because the proposed program includes visual inspections and mechanical examination techniques that can determine whether loss of material due to selective leaching is occurring.

In LRA Table 3.3.2-3, the applicant stated that steel and gray cast iron components exposed to condensation (internal) are being managed for the loss of material by the Flow-Accelerated Corrosion Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination. Even though the GALL Report does not include flow-accelerated corrosion as an aging effect for steel or gray cast iron exposed to condensation, the GALL Report does indicate that ferrous components are susceptible to flow-accelerated corrosion. The staff noted that the applicant is also managing the aging of these components for loss of material due to general, pitting, crevice, and MIC, which are applicable aging mechanisms. The staff also noted that the applicant is managing selective leaching for the gray cast iron components exposed to condensation, which is also consistent with the guidance in the GALL Report.

The staff's evaluation of the applicant's Flow-Accelerated Corrosion Program is documented in SER Section 3.0.3.1.8. The staff finds the applicant's proposal to manage aging using the Flow-Accelerated Corrosion Program acceptable because the program includes periodic inspections, including ultrasonic testing to determine wall thickness, which is adequate to detect and manage the aging effects so that the intended functions will remain consistent with the CLB for the period of extended operation

In LRA Table 3.3.2-3, the applicant stated that for copper-alloy bolting exposed to air with steam or water leakage (external), there is no AERM, and no AMP is proposed. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that there is a potential for aging in these components depending on the contaminants they are exposed to because the GALL Report states that copper-Zn alloys greater than 15 percent Zn are susceptible to SCC, selective leaching (except for inhibited brass), pitting, and crevice corrosion. By letter dated May 2, 2011, the staff issued RAI 3.3.2-1 requesting that the applicant state why the specific environment, air with steam or water leakage (external), will not induce loss of material or cracking in copper-alloy bolting.

In its response dated June 3, 2011, the applicant stated that the bolting in the auxiliary steam and station heating systems is ASTM B98, which is a copper-silicon alloy that contains a maximum of 1.5 percent Zn and no aluminum. The applicant also stated that it considered its air with steam or water leakage environment to be less aggressive than the air with borated water leakage environment used in the GALL Report and aligned the components with GALL Report, items V.F-5 and VII.J-5, for copper alloy with less than 15 percent Zn components exposed to air with borated water leakage. The GALL Report, items V.F-5 and VII.J-5, state that this combination has no AERM. The staff noted that the definition of copper alloy with less than 15 percent Zn in the GALL Report, Section IX.C, states that this material is resistant to SCC, selective leaching, and pitting and crevice corrosion. The staff finds the applicant's response, and its determination that copper alloy with less than 15 percent bolting exposed to air with steam or water leakage has no AERM, acceptable because it is consistent with the definition of copper alloy with less than 15 percent Zn and items V.F-5 and VII.J-5 in the GALL Report. The staff's concern described in RAI 3.3.2-1 is resolved.

In LRA Table 3.3.2-3 the applicant stated that the copper-alloy heat exchanger tubing exposed to steam (internal) is being managed for loss of material by the PWR Water Chemistry Program and One-Time Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that this heat exchanger does not have a heat transfer function; therefore, it does not need to be managed for reduction of heat transfer. Based on its review of the GALL Report, which states that copper-alloy components exposed to environments, which bound the effects of exposure to steam (i.e., raw water or condensation), are susceptible to loss of material, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's PWR Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff noted that the applicant's PWR Water Chemistry Program mitigates the occurrence of loss of material by maintaining the concentration of containments below the levels known to cause loss of material through adherence to the EPRI guidance documents. The staff also noted that the applicant's One-Time Inspection Program will visually or physically examine a representative sample of components at locations susceptible to concentration of contaminants. Inspection findings that do not meet the acceptance criteria will be tracked through the applicant's Corrective Action Program. The staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program and One-Time Inspection Program acceptable because contaminants that are known to cause loss of material will be maintained within the EPRI limits, and inspection will verify the efficacy of the PWR Water Chemistry Program.

In LRA Table 3.3.2-3 the applicant stated that the copper alloy with greater than 15 percent Zn valve bodies exposed to treated water greater than 60 °C (140 °F) are being managed for cracking by the PWR Water Chemistry Program and the One-Time Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that copper-alloy components exposed to treated water are addressed for BWR components in the SRP-LR, Table 3.3-1, item 31, which states that the combination is susceptible to loss of material due to pitting, crevice, and galvanic corrosion. The staff also noted that copper alloy with greater than 15 percent Zn exposed to treated water are addressed in the SRP-LR, Table 3.3-1, item 84, which states that the combination is susceptible to loss of material due to selective leaching. The staff further noted that the applicant addressed loss of material due to pitting, crevice, and galvanic corrosion and selective leaching in other AMR items in Table 3.3.2-3. The applicant identified cracking as an additional aging effect. Based on its review of the SRP-LR, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's PWR Water Chemistry Program and the One-Time Inspection are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff noted that the applicant's PWR Water Chemistry Program mitigates the occurrence of loss of material, cracking, and reduction of heat transfer by managing the concentration of contaminants in the primary, secondary, and auxiliary systems below the levels known to cause loss of material through adherence to the EPRI guidance documents. The staff also noted that the applicant's One-Time Inspection Program will visually or physically examine a representative sample of components at locations susceptible to concentration of contaminants. Inspection findings that do not meet the acceptance criteria will be tracked through the applicant's Corrective Action Program. The staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program and One-Time Inspection Program acceptable because contaminants that are known to cause loss of material and cracking will be maintained within the EPRI limits, and inspection will verify the efficacy of the PWR Water Chemistry Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds, that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.4 Auxiliary Systems—Boron Recovery System—Aging Management Review Results—LRA Table 3.3.2-4

In LRA Tables 3.3.2-4, 3.3.2-5, 3.3.2-7, 3.3.2-8, 3.3.2-11, 3.3.2-14, 3.3.2-16, 3.3.2-18, 3.3.2-21, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-26, 3.3.2-27, 3.3.2-28, and 3.3.2-31, the applicant stated that the stainless steel bolting exposed to air with steam or water leakage (external) is being managed for loss of material and cracking by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because GALL Report Table IX.C states that stainless steels are susceptible to loss of material due to pitting and crevice corrosion and cracking due to SCC. GALL Report AMP XI.M18, “Bolting Integrity,” indicates that a loss of preload is an aging effect that is monitored for bolting materials. The loss of preload aging effect is the subject of RAI B.2.4-4, as discussed in SER Section 3.2.2.3.1. Thus, the aging effects of concern are loss of material and cracking, which are addressed in the AMR.

The staff’s evaluation of the applicant’s Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant’s proposal to manage aging using the Bolting Integrity Program acceptable because it will use periodic visual inspections that would detect loss of material and cracking prior to loss of component intended function.

In LRA Tables 3.3.2-4, 3.3.2-5, 3.3.2-7, 3.3.2-8, 3.3.2-11, 3.3.2-14, 3.3.2-16, 3.3.2-18, 3.3.2-21, 3.3.2-22, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-26, 3.3.2-28, and 3.3.2-31, the applicant stated that the stainless steel bolting exposed to air-indoor uncontrolled (external) is being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because even though stainless steel bolting exposed to air-indoor is not specifically addressed in the GALL Report, Table IX.E of the GALL Report states that loss of preload can occur independent of environmental conditions because it can be caused by thermal or mechanical effects. Additionally, Table IX.C of the GALL Report states that stainless steel material is susceptible to a variety of aging effects and mechanisms, including loss of material due to pitting and crevice corrosion and cracking due to SCC. The staff noted that the environment of interest, air-indoor, would not induce SCC or loss of material in stainless steel material because stainless steel is inherently resistant to corrosion in the air-indoor environment. Therefore, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff’s evaluation of the applicant’s Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant’s proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts to verify that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

In LRA Tables 3.3.2-4 and 3.3.2-5, the applicant stated that the stainless steel tanks (concentrates storage tank, DB-T16, and the boric acid addition tanks, DB-T7-1 and DB-T7-2, found in Tables 3.3.2-4 and 3.3.2-5, respectively) exposed to moist air (internal) are being managed for cracking by the One-Time Inspection Program. The AMR items cite generic note H.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material for this component, material, and environment combination in other AMR items in LRA Tables 3.3.2-4 and 3.3.2-5. Based on its review of the GALL Report, Table IX.C, which states that stainless steel is susceptible to loss of material and cracking, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material for this component, material, and environment combination in other AMR items in LRA Tables 3.3.2-4 and 3.3.2-5. Based on its review of the GALL Report, Table IX.C, which states that stainless steel components are susceptible to loss of material and cracking, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.2.11. The staff noted that the One-Time Inspection Program is intended to confirm the absence of aging effects or confirm that aging is progressing very slowly. The staff also noted that a moist air environment can be inconsistent over time, resulting in aging effects that may not occur consistently and may not be identified by a one-time inspection. However, in LRA Tables 3.3.2-4 and 3.3.2-5, the applicant proposed to use its One-Time Inspection Program to manage aging for components exposed to moist air. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that the One-Time Inspection Program is still credited to confirm the absence of aging effects at the air-water interface when an appropriate program is being used to manage the surface below the air-water interface and a periodic program is being used to manage the surface above the air-water interface. The staff noted that the stainless steel concentrates storage tank in LRA Table 3.3.2-4 and the boric acid addition tanks in LRA Table 3.3.2-5 are being managed for loss of material and cracking below the air-water interface by the PWR Water Chemistry and One-Time Inspection Programs. Above the air-water interface, no AMP is proposed. The staff finds the applicant's response not acceptable because the applicant did not identify the periodic program used above the air-water interface to managing aging. By letter dated July 12, 2011, the staff issued RAI 3.2.2.2.3.6-2 asking the applicant to state how aging will be managed above the air-water interface.

In its response dated August 17, 2011, the applicant stated that the concentrates storage tank (DB-T16) and the boric acid addition tanks (DB-T7-1 and DB-T7-2) will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting for the above the air-water interface subject to condensation. The staff finds this acceptable because the applicant also identified a periodic opportunistic program that will use the methods of enhanced visual, surface examination, or volumetric to manage the aging effect of cracking for this component, material, and environment combination. The staff's concerns described in RAIs 3.2.2.1.26-1 and 3.2.2.2.3.6-2 are resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.5 Auxiliary Systems—Chemical Addition System—Aging Management Review Results—LRA Table 3.3.2-5

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel tanks exposed to moist air, which are being managed for cracking by the One-Time Inspection Program citing generic note H, is documented in Section 3.3.2.3.4.

3.3.2.3.6 Auxiliary Systems—Circulating Water System—Aging Management Review Results—LRA Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the circulating water system component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.7 Auxiliary Systems—Component Cooling Water System—Aging Management Review Results—LRA Table 3.3.2-7

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

3.3.2.3.8 Auxiliary Systems—Containment Hydrogen Control System—Aging Management Review Results—LRA Table 3.3.2-8

The staff's evaluation for steel bolting exposed to condensation (external), which is being managed for loss of preload and cracking by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel heat exchanger components exposed to air-indoor uncontrolled, which are being managed for reduction in heat transfer by the One-Time Inspection Program citing generic note H, is documented in Section 3.3.2.3.1.

3.3.2.3.9 Auxiliary Systems—Containment Purge System—Aging Management Review Results—LRA Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the containment purge system component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.10 Auxiliary Systems—Containment Vacuum Relief System—Aging Management Review Results—LRA Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the containment vacuum relief system component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.11 Auxiliary Systems—Demineralized Water Storage System—Aging Management Review Results—LRA Table 3.3.2-11

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

3.3.2.3.12 Auxiliary Systems—Emergency Diesel Generators System—Aging Management Review Results—LRA Table 3.3.2-12

In LRA Tables 3.3.2-12 and 3.3.2-14, the applicant stated that aluminum strainers and heat exchanger shell components exposed internally to lubricating oil are being managed for loss of material by the Lubricating Oil Analysis and One-Time Inspection Programs. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that while this combination was not addressed in Revision 1 of the GALL Report, the combination is addressed in Revision 2 of the GALL Report. Revision 2 of the GALL Report recommends that aluminum piping, piping elements, and piping components exposed to lubricating oil be managed for loss of material by GALL Report AMP XI.M39, "Lubricating Oil Analysis," and XI.M32, "One-Time Inspection." Based on its review of the GALL Report, Revision 2, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11. The staff finds the applicant's proposal to manage aging using the Lubricating Oil Analysis and One-Time Inspection Programs acceptable because the Lubricating Oil Analysis Program will monitor and control the presence of contaminants in the lubricating oil to preserve an environment that is not conducive to loss of material, the One-Time Inspection will verify that aging is not occurring, and it is consistent with the methodology for managing loss of material for this component, material, and environment combination in Revision 2 of the GALL Report.

In LRA Tables 3.3.2-12 and 3.3.2-14, the applicant stated that for steel filter bodies exposed to lubricating oil, loss of material is not applicable, and no AMP is proposed. The AMR items cite generic note I. Items associated with steel filter bodies in Tables 3.3.2-12 and 3.3.2-14 cite plant-specific note 0325, which states that the aging effects of steel in a lubricating oil environment are not applicable in the air intake filter bodies in the diesel systems due to the regular replacement of the lubricating oil.

GALL Report, items VII.H2.AP-127 and VII.G.AP-127, recommend that loss of material for steel components exposed to lubricating oil be managed by GALL Report AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection," Programs. The staff evaluated the applicant's claim and noted that it is not clear to the staff why the applicant does not consider loss of material to be an applicable aging effect. By letter dated May 2, 2011, the staff issued RAI 3.3.2.3.12-1 requesting that the applicant state why loss of material is not an applicable aging effect for the steel filter bodies.

In its response dated June 3, 2011, the applicant stated that the oil in the air intake filters functions as filter media and is not subject to the Lubricating Oil Analysis Program. The applicant also stated that because of the potential for water accumulation in the oil, the LRA was revised to manage steel air intake filter bodies exposed to lubricating oil for loss of material with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program.

The staff finds the applicant's response acceptable because the visual inspections in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program are capable of detecting loss of material in steel filter bodies before the loss of intended function. The staff's concern described in RAI 3.3.2.3.12-1 is resolved

In LRA Tables 3.3.2-12, 3.3.2-17, and 3.3.2-30, the applicant stated that for stainless steel piping, strainer bodies, strainer screens, tubing, and valve bodies exposed to air (internal or external), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G.

The staff noted that in LRA Table 3.0-1, "Process Environments," air is defined as an air environment that contains some amount of moisture or contaminants. The staff reviewed the associated items in the LRA and noted that loss of material and cracking can occur in stainless steel components exposed to air (internal or external) depending on the presence of contaminants and moisture. The staff also noted that loss of material and cracking can occur in stainless steel components exposed to outdoor air, depending on whether the outdoor air environment is within $^{1}/_{2}$ mi of a highway which is treated with salt in the wintertime, the soil contains more than a trace amount of chlorides, the plant has cooling towers where the water is treated with chlorine or chlorine compounds, or the area is subject to chloride contamination from other agricultural or industrial sources. By letter dated May 2, 2011, the staff issued RAI 3.2.2.3.4-2 requesting that the applicant state why air (internal or external) and outdoor air will not induce loss of material or cracking in stainless steel.

In its response dated June 3, 2011, the applicant stated that the air environment identified in LRA Tables 3.3.2-12 and 3.3.2-30 is in the air start subsystem for the diesel engines. The applicant also stated that the majority of the air environment is compressed air taken from inside the auxiliary building or SBO diesel building that has been processed through moisture separators but may contain some amount of moisture. The applicant further stated that condensation is only expected in specific locations within the system and that the areas where moisture is expected to accumulate are evaluated as being exposed to condensation, not air. The staff noted that Revision 2 of the GALL Report, item V.F.EP-82, recommends that stainless steel components exposed internally to uncontrolled indoor air have no AERMs. The staff finds the applicant's response, and its proposal that these components in LRA Tables 3.3.2-12 and 3.3.2-30 have no AERMs, acceptable because the air environment is from an indoor air source that would not be expected to contain halides, and the applicant evaluated those locations where moisture accumulation could occur and is managing those locations for exposure to condensation.

In its response to RAI 3.2.2.3.4-2, the applicant stated that the air environment identified in LRA Table 3.3.2-17 is from the instrument air system, which is normally dry and free of contaminants. The subject components are in the instrument air lines to the containment radiation monitors where there is a moisture separator and drain trap. The applicant further stated that condensation is only expected in specific locations within the system and that the areas where moisture is expected to accumulate are evaluated as being exposed to condensation, not air. The staff finds the applicant's response, and its proposal that these components in LRA Table 3.3.2-17 have no AERMs, acceptable because the air environment is from an air source, which would not be expected to contain halides, and the applicant evaluated those locations where moisture accumulation could occur and is managing those locations for exposure to condensation. The staff's concern described in RAI 3.2.2.3.4-2 is resolved.

In LRA Table 3.3.2-12, the applicant originally stated that for stainless steel tubing exposed to air-outdoor (internal), there is no aging effect, and no AMP is proposed. The AMR item cites generic note G. In its response to RAI B.2.2-2 dated May 24, 2011, the applicant revised this item and added an additional item as part of an extent of condition review. The revised items state that stainless steel tubing exposed to air-outdoor is being managed for loss of material and cracking by the External Surfaces Monitoring Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment combination. Based on its review of Revision 2 of the GALL Report, which states that stainless steel components exposed to outdoor air are susceptible to loss of material and cracking if the outdoor air contains contaminants, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff noted that Revision 2 of the GALL Report recommends AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," to manage loss of material and cracking for stainless steel components exposed to outdoor air containing contaminants. The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring Program acceptable because the program includes periodic visual inspections and walkdowns, which are capable of identifying loss of material and cracking prior to loss of component intended function, and it is consistent with the recommendations in Revision 2 of the GALL Report.

In LRA Table 3.3.2-12, the applicant stated there is a TLAA for stainless steel flexible connections and tubing and steel piping, silencers, and valve bodies exposed to diesel exhaust, which cite generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.3.1, for this component and material. The staff's evaluation of the TLAA for non-Class 1 piping and in-line components is documented in SER Section 4.3.3.1.2.

The staff's evaluation for steel bolting exposed to air-outdoor (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.1.

In LRA Tables 3.3.2-12, 3.3.2-14, and 3.3.2-15, the applicant stated that for elastomer flexible connections exposed to fuel oil and lubricating oil internal environments, there is no aging effect, and no AMP is proposed. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and could not confirm that no credible aging effects are applicable for this component, material, and environment combination because the applicant did not identify the specific material of the flexible connections. The staff noted that certain elastomers, such as natural rubbers and ethylene-propylene-diene (EPDM), are not resistant to fuel oil or lubricating oil. By letter dated May 2, 2011, the staff issued RAI 3.3.2.3.12-2 requesting that the applicant state the materials of construction for the flexible connections exposed to fuel oil and lubricating oil.

In its response dated June 3, 2011, the applicant stated that the material of construction of the flexible connections exposed to fuel and lubricating oil in the EDGs and fire protection systems is neoprene rubber. However, in the fuel oil system, the material of construction of the flexible connections exposed to fuel oil is unknown; therefore, the applicant revised Table A-1 to include a new license renewal commitment (Commitment No. 41) to establish a preventive maintenance task prior to the period of extended operation to periodically replace the flexible connection exposed to fuel oil in the fuel oil system.

The staff finds the applicant's response acceptable because neoprene is synthetic rubber that in general has good chemical stability and is resistant to fuel oil and lubricating oil; therefore, it has no aging effects that need to be managed. Additionally, the applicant committed to periodically replace the flexible connection exposed to fuel oil in the fuel oil system, which makes the flexible connection a short-lived component; therefore, it does not need to be included in an AMP. The staff's concern described in RAI 3.3.2.3.12-2 is resolved.

LRA Table 3.3.2-12, as amended by letter dated June 3, 2011, in response to RAI 3.3.2.2.13-1, was revised to add elastomer flexible connections in an air-outdoor internal environment with an aging effect of loss of material due to wear and credited the new plant-specific Inspection of Internal Surface in Miscellaneous Piping and Ducting Program to manage the aging effect. The applicant cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, Section VII.G, which addresses elastomer components exposed to air-outdoor and recommends the Fire Protection Program to manage the aging effect of increased hardness and loss of strength. However, the applicant identified an additional aging effect. Although the GALL Report item is identified in the fire protection system, the applicant also addressed the GALL Report identified aging effect for this component, material, and environment combination in AMR items in LRA Table 3.3.2-12, "Emergency Diesel Generator System." The staff also noted that the external environment for these flexible connections is air-indoor uncontrolled which will be managed for loss of material by the External Surfaces Monitoring Program. The staff's evaluation of this material, environment, aging effect and program and RAI 3.3.2.2.13-1 is documented in SER Section 3.3.2.2.13.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in Section 3.0.3.3.7. The staff finds the applicant's proposal to manage loss of material of elastomer flexible connections in an air-outdoor internal environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable because: (a) the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes visual and physical (manipulation or prodding) examination of subject non-metallic, flexible (elastomeric) components in various environments for evidence of loss of material due to wear; (b) the External Surfaces Monitoring Program will also be used to manage loss of material on the external surfaces; (c) the "scope of program" program element of GALL Report (Revision 2) AMP XI.M36 allows the use of AMP XI.M36 for managing internal aging effects for polymeric (elastomers are a subset of polymers) components as long as material and environment combinations are the same for the internal and external surfaces; (d) for this material and environment combination, the internal and external environments are the similar enough for external inspections to detect loss of material due to wear on either surface, and (e) the External Surfaces Monitoring Program conducts periodic visual inspections accompanied by physical manipulation of the elastomeric material that are capable of detecting wear in elastomeric components.

In LRA Tables 3.3.2-12, 3.3.2-18, and 3.3.2-30, the applicant stated that the copper-alloy components with greater than 15 percent Zn exposed to closed-cooling water are being managed for cracking by the Closed Cooling Water Chemistry Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, item V.D1-19 (EP-27), which addresses copper-alloy heat exchanger components with greater than 15 percent Zn exposed to closed-cycle cooling water and recommends the Selective Leaching of Materials Program to manage loss of material due to selective leaching. Additionally, GALL Report, items VII.C2-2 (AP-80) and VII.E1-2 (AP-34), address copper-alloy heat exchanger components exposed to closed-cycle cooling water and recommend the Closed-Cycle Cooling Water System Program to manage reduction of heat transfer due to fouling and loss of material due to pitting, crevice, and galvanic corrosion. The staff also noted that the applicant addressed these GALL Report identified aging effects for this component, material, and environment combination in AMR items in LRA Tables 3.3.2-12, 3.3.2-18, and 3.3.2-30.

The staff's evaluation of the applicant's Closed Cooling Water System Program is documented in SER Section 3.0.3.2.4. The staff finds the applicant's proposal to manage aging using the Closed Cooling Water System Program acceptable because the water chemistry controls are capable of mitigating the environmental effects on SCC, and the periodic inspections can detect the presence or extent of cracking prior to loss of intended function in a manner consistent with the current staff guidance in the GALL Report.

The staff's evaluation for copper alloy and copper alloy with greater than 15 percent Zn heat exchanger tubes exposed to outdoor air (external or internal), which cite generic note G, is documented in Section 3.3.2.3.1.

In LRA Tables 3.3.2-12 and 3.3.2-30, the applicant stated that for aluminum flame arrestors exposed to outdoor air (external/internal) and strainers, filter housings, and valves exposed to air (internal), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. By letter dated May 2, 2011, the staff issued RAI 3.2.2.3.4-2 requesting that the applicant state why the air (internal) environment will not induce loss of material or cracking in stainless steel components. In its response dated June 3, 2011, the applicant stated that air environment identified in LRA Tables 3.3.2-12 and 3.3.2-30 is in the air start subsystem for the diesel engines. The applicant also stated that the majority of the air environment is compressed air taken from inside the auxiliary building or SBO diesel building that has been processed through moisture separators but may contain some amount of moisture. The applicant further stated that condensation is only expected in specific locations within the system and that the areas where moisture is expected to accumulate are evaluated as being exposed to condensation, not air. The staff noted the GALL Report, item V.F-2, states that aluminum components exposed to air-indoor uncontrolled (internal/external) have no aging effects or mechanisms, and no AMP is recommended. The staff reviewed the associated items in the LRA and confirmed that no aging effect is applicable for strainers, filter housings, and valves exposed to air (internal) because, even though aluminum exposed to air (internal) is not specifically addressed, air (internal) is an equivalent environment as the uncontrolled indoor air based on the applicant's response to RAI 3.2.2.3.4-2; therefore, there are no aging effects. The staff's concern described in RAI 3.2.2.3.4-2 is resolved.

The staff noted that for the material and environment of interest, aluminum and air-outdoor (external), the GALL Report, Revision 2, (Tables V.E. and VII.I) recommends AMP XI.M36 "External Surfaces Monitoring of Mechanical Components," to manage the aging effects of loss of material due to pitting and crevice corrosion for aluminum components. The staff further noted that, as described in the Metals Handbook, Volume 13, "Corrosion," 9th Edition, by the American Society of Metals, corrosion of aluminum in the passive range is usually manifested by random formation of pits. By letter dated May 2, 2011, the staff issued RAI 3.2.2.3.4-1, requesting the applicant justify why the specific environment, outdoor air (external), will not induce loss of material in aluminum.

In its response dated June 3, 2011, the applicant stated that loss of material due to crevice or pitting corrosion could not be ruled out for aluminum components exposed to an outdoor air environment. The applicant further stated that the External Surfaces Monitoring Program has been revised to include the management of aging for the aforementioned aluminum components exposed to an outdoor air environment through periodic visual inspections and surveillance activities. The staff finds the applicant's response acceptable because, consistent with the recommendations of the GALL Report, crevice and pitting corrosion can be detected by the periodic visual inspections under the External Surfaces Monitoring Program. The staff's concern described in RAI 3.2.2.3.4-1 is resolved.

In LRA Tables 3.3.2-12 and 3.3.2-30, the applicant stated that the copper alloy greater than 15 percent Zn heat exchanger tubes exposed to air-outdoor (external) are being managed for reduction in heat transfer by the One-Time Inspection Program. The AMR items cite generic note H.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because the GALL Report, Table IX.B, states that heat exchanger components are susceptible to reduction of heat transfer due to fouling. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in other AMR items in LRA Tables 3.3.2-12 and 3.3.2-30.

In LRA Tables 3.3.2-12 and 3.3.2-30, the applicant proposed to use its One-Time Inspection Program. The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.1.11. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that it revised the LRA to manage this aging effect through the use of the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, as stated in its response to RAI 3.3.2.71-2 dated May 24, 2011. The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's response, and its proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, acceptable because equipment must be disassembled to gain access to the external surfaces of the heat exchanger components. Additionally, the program includes visual periodic opportunistic inspections, which are capable of managing reduction of heat transfer through the period of extended operation. The staff's concern described above is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.13 Auxiliary Systems—Emergency Ventilation System—Aging Management Review Results—LRA Table 3.3.2-13

The staff's evaluation for glass filter housings exposed to air with borated water leakage (external)—for which no aging effect, for which no AMP is proposed, and for which the applicant cites generic note G—is documented in SER Section 3.3.2.3.1.

3.3.2.3.14 Auxiliary Systems—Fire Protection System—Aging Management Review Results—LRA Table 3.3.2-14

The staff's evaluation for aluminum strainers and heat exchanger shell components exposed internally to lubricating oil which are being managed for loss of material by the Lubricating Oil Analysis and One-Time Inspection Programs and cite generic note G is documented in SER Section 3.3.2.3.12.

The staff's evaluation for steel filter bodies exposed to lubricating oil—for which the applicant stated that loss of material is not applicable, for which no AMP is proposed, and for which the applicant cites generic note I—is documented in Section 3.3.2.3.12.

In LRA Table 3.3.2-14, the applicant stated there is a TLAA for stainless steel flexible connections and steel piping and silencer in the fire protection system exposed to diesel exhaust and steel piping and valve bodies exposed to raw water, which cite generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.3.1, for this component and material. The staff's evaluation of the TLAA for non-Class 1 piping and in-line components is documented in SER Section 4.3.3.1.2.

The staff's evaluation for steel bolting exposed to air-outdoor (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

In LRA Tables 3.3.2-14 and 3.3.2-31, the applicant stated that the gray cast iron pump casing and piping exposed to moist air (internal or external) is being managed for loss of material by the Selective Leaching Inspection Program. The AMR items cite generic note G or H. The AMR items associated with the gray cast iron pump casing in Table 3.3.2-14 also cite plant-specific note 0321, which states that the Selective Leaching Inspection Program will detect and characterize loss of material due to selective leaching at the air-water interface on the diesel fire protection pump.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant include all the credible aging effects for this component, material, and environment combination. The staff noted that even though gray cast iron exposed to moist air is not specifically addressed in the GALL Report, GALL Report Table IX.C states that gray cast iron is susceptible to the same aging effects as steel (which include loss of material due to general, pitting, and crevice corrosion when exposed to moist air or condensation) as well as loss of material due to selective leaching. The staff also noted that the applicant addressed loss of material due to other mechanisms for these gray cast iron components in other AMR items in LRA Tables 3.3.2-14 and 3.3.2-31. Based on its review of the GALL Report Table IX.C and the LRA, the staff finds that the applicant identified all of the credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Selective Leaching Inspection Program is documented in SER Section 3.0.3.2.16. The staff noted that the applicant's Selective Leaching Inspection Program will characterize the internal and external surface conditions of components that may be susceptible to selective leaching and assess their ability to perform the intended functions during the period of extended operation. The staff finds the applicant's proposal to manage aging using the Selective Leaching Inspection Program acceptable because the proposed program includes visual inspections and mechanical examination techniques that can determine whether loss of material due to selective leaching is occurring.

The staff's evaluation for flexible connections exposed to fuel oil and lubricating oil internal environments, with no aging effect, no AMP proposed, and citing generic note F, is documented in SER Section 3.3.2.3.12.

The staff's evaluation for copper alloy and copper alloy with greater than 15 percent Zn valve bodies and spray nozzles exposed to outdoor air (external or internal), which cite generic note G, is documented in Section 3.3.2.3.1.

In LRA Table 3.3.2-14, the applicant stated that the stainless steel heat exchanger tubes exposed to steam (external) are being managed for reduction in heat transfer by the One-Time Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. Based on its review of the GALL Report, which states that stainless steel piping components exposed to steam are subject to loss of material and cracking, the staff finds that the applicant has not identified all credible aging effects for this component, material, and environment combination. By letter dated July 27, 2011, the staff issued RAI 3.3.2.14-1 requesting that the applicant justify why loss of material and SCC are not applicable aging effects for the fire water storage tank heat exchanger tubes exposed to steam.

In its response dated August 26, 2011, the applicant stated that the only aging mechanism that is identified as causing the aging effect of reduction of heat transfer is the aging mechanism of fouling. Loss of material and cracking (due to the aging mechanism of SCC) are potential aging effects for the fire water storage tank heat exchanger tubes exposed to steam and could ultimately affect the pressure boundary function of the tubes, but they would not affect the license renewal function of heat transfer for this heat exchanger. The fire water storage tank heat exchanger tubes are not credited with a license renewal pressure boundary function. Should the heat exchanger tubes leak, fire water would not leak from the tubes; rather, the higher pressure (i.e., approximately 50 psig) steam from the auxiliary steam system on the external surfaces of the tubes would pass through the tubes and mix with fire water (approximately 25 psig), thereby continuing to add heat to the water. The fire water storage tank level would increase due to water entering the system, but levels in the tank could be controlled (i.e., feed-and-bleed) to prevent the tank from overflowing onto the ground. A breach of the heat exchanger tubes would result in continued heat transfer to fire water, and it would not prevent the fire water system from performing its functions. Therefore, the applicant stated that loss of material and SCC are not applicable license renewal aging effects for the fire water storage tank heat exchanger tubes exposed to steam.

The staff reviewed the applicant's response and found it unacceptable because it is unclear to the staff whether the fire water storage tank is designed to contain a water/steam environment, which could occur if the heat exchanger tubes failed. In a supplemental response dated October 7, 2011, the applicant revised the LRA to remove from the scope of license renewal the fire water storage tank heat exchanger (DB-E52), fire water storage tank recirculation pump casing (DB-P114), and associated components. The applicant stated that the fire water storage tank heat exchanger and recirculation pump are not within the scope of license renewal because the subject components do not satisfy the scoping criteria of 10 CFR 54.4(a)(1), (a)(2), or (a)(3) since they are only used to establish initial conditions associated with event assumptions and perform no fire protection functions. The applicant also stated it is the monitoring of the fire water storage tank that is credited with ensuring the appropriate initial conditions and, therefore, the heat exchanger and recirculation pump are not within the scope of license renewal for the fire protection regulated event.

However, it is the staff's position that these components are required to maintain temperature in the fire water tank above 35 °F. The Fire Hazards Analysis Report, Section 8.1.2, "Fire Suppression Water System," states that "the temperature of the contained water supply is greater than 35 °F every 24 hours during October through March," which is confirmed using surveillance. It is the staff's position that these components should not be excluded from the fire water system on the basis that they are not required to function to suppress a fire; rather they should be included to support the tank's primary function of supplying temperate water. A second teleconference was held on November 1, 2011, to discuss the staff's position that the deletion of these components was not consistent with the CLB. By letter dated November 8, 2011, the staff issued RAI 3.3.2.14-2 requesting that the applicant:

- Justify how the fire water storage tank will be maintained greater than 35 °F at all times without the heat exchanger or provide an appropriate AMP to manage aging for the original component and subcomponents inclusive of all applicable aging effects.
- If the components are excluded and other methods are used for the tank's primary temperature function, then supply the procedures that would be used to maintain the fire water storage tank level and temperature.
- Include any additional AMR items related to the proposed deletion, such as piping components and elements that would no longer be age managed in the LRA.
- Document the FHAR sections that would support removal of these components while retaining the primary function of adequate fire water supply temperature and allowing consistency to the plant's CLB.

In its response dated November 23, 2011, the applicant stated that the fire water storage tank heat exchanger and associated components are in the scope of license renewal and that these items are appropriately managed for all applicable aging effects. The applicant also stated that in Table 3.3.2-14, the stainless steel heat exchanger tubes exposed to steam (external) are being managed for reduction in heat transfer, cracking, and loss of material. The staff finds the applicant's response and its proposal to manage these aging effects with the PWR Water Chemistry and the One-Time Inspection Programs acceptable because these programs will establish plant water chemistry control parameters within limits that mitigate aging, and the One-Time Inspection Program will include visual inspection techniques capable of detecting reduction of heat transfer, cracking, and loss of material to verify the effectiveness of the water chemistry controls. The staff's concerns described in RAIs 3.3.2.14-1 and 3.3.2.14-2 are resolved.

In LRA Table 3.3.2-14, the applicant proposed to manage the reduction of heat transfer aging effect using its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that this aging effect will be managed by the PWR Water Chemistry Program and supplemented by the One-Time Inspection Program to verify the adequacy of the water chemistry management. The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff finds the applicant's response, and its proposal to manage aging using PWR Water Chemistry and One-Time Inspection Programs, acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate aging, and the One-Time Inspection Program includes visual inspection techniques capable of detecting reduction of heat transfer to verify the effectiveness of the water chemistry controls. The staff's concern described in RAI 3.2.2.1.26-1 is resolved.

In LRA Table 3.3.2-14, the applicant stated that steel bolting exposed to an external environment of raw water are being managed for cracking by the Collection, Drainage, and Treatment Components Inspection Program. The AMR item cites generic note G. Items associated with bolting in LRA Table 3.3.2-14 cite plant-specific note 324, which states that the subject bolting exposed to a raw water (external) environment is associated with the diesel fire pump (DB-P5-2) casing.

The staff's evaluation of the Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the applicant's program is a new plant-specific program that uses enhanced visual inspection on a periodic basis to detect cracking. However, it is not clear how the applicant proposes to perform visual inspection of the diesel fire pump casing bolting in an external environment of raw water to detect cracking, since this environment implies that the bolting will be underwater. GALL Report AMP XI.M18, "Bolting Integrity," allows visual inspection of bolting to detect cracking. By letter dated May 2, 2011, the staff issued RAI 3.3.2.3.14-2 requesting the applicant to justify how visual inspections will detect cracking of steel bolting underwater in an external environment of raw water.

In its response dated June 3, 2011, the applicant stated that it will not use visual inspections to inspect bolting underwater, but will conduct enhanced visual inspections opportunistically when components are disassembled or drained. The applicant also stated if an opportunistic inspection has not been conducted prior to the period of extended operation, a focused inspection will be conducted, and any evidence of degradation will be documented and evaluated through the Corrective Action Program. The staff finds this acceptable because the applicant's plan to use opportunistic enhanced visual inspections when components are disassembled or drained is sufficient to detect cracks in steel bolting exposed to raw water. The staff's concern described in RAI 3.3.2.3.14-2 is resolved.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material for this component, material, and environment combination in AMR items in LRA Table 3.3.2-14; however, the applicant did not identify loss of pre-load as an aging effect for this component, material, and environment. The staff noted, as identified in EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," and NUREG-1833, that loss of pre-load for bolting can occur in any environment. By letter dated May 2, 2011, the staff issued RAI 3.3.2.3.14-1 requesting the applicant to justify why loss of pre-load is not identified as an aging effect for steel bolting in an environment of raw water.

In its response dated June 3, 2011, the applicant stated that the Fire Protection System's AMR concerning loss of pre-load was conducted based on the guidance in EPRI Technical Report 1010639 considering influences for a pre-load aging effect to occur of thermal effects, gasket creep, embedment, and self-loosening. The applicant further stated that pre-load is not an aging effect because:

- The system's normal water temperature is far below the level needed to create a thermal effect.
- Gasket creep is a very small influence.
- The effect of embedment is considered to be small because the pump is not subject to large thermal, vibrational, or pressure-induced cyclic loading while in a relatively stagnant atmospheric pool and normally in a standby mode.
- Self-loosening is precluded by good bolting practices and early detection inservice life by maintenance activities.

The staff discussed this response with the applicant during a teleconference on August 2, 2011, indicating that the staff does not agree with the FENOC response to this RAI and that aging mechanisms do exist and loss of pre-load could occur.

In its response dated August 26, 2011, the applicant replaced the previous response to RAI 3.3.2.3.14-1, submitted under letter dated June 3, 2011, in its entirety and revised Table 3.3.2-14 to add loss of pre-load as an aging effect for steel bolting exposed to an external environment of raw water. The applicant stated that this loss of pre-load will be managed by the Bolting Integrity Program, and cited footnote H. The applicant also stated that the bolting in the Fire Protection System that is exposed to an external environment of raw water is associated with the diesel fire pump column that is submerged in raw water supplied by Lake Erie. The applicant further stated that, in addition to the Bolting Integrity Program, there are other opportunities to identify loss of pre-load in the diesel fire pump column bolting, such as during pump flow testing conducted in accordance with the Fire Protection Program or during inspection of the diesel fire pump column bolting that is done in accordance with the Collection, Drainage, and Treatment Component Inspection Program.

The staff's evaluation of the Bolting Integrity Program is documented in Section 3.0.3.2.2. The staff finds the applicant response acceptable because (1) the Bolting Integrity Program, which is consistent with the GALL Report AMP XI.M18 will adequately manage loss of pre-load, (2) the pump flow testing will detect changes in flow if there are any leakages through the bolting, and (3) periodic inspections conducted by the Collection, Drainage, and Treatment Component Inspection Program to detect cracking in steel bolting will also detect loss of pre-load. The staff's concern described in RAI 3.3.2.3.14-1 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant 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).

3.3.2.3.15 Auxiliary Systems—Fuel Oil System—Aging Management Review Results—LRA Table 3.3.2-15

The staff's evaluation for flexible connections exposed to fuel oil and lubricating oil internal environments, with no aging effect and no AMP proposed citing generic note F, is documented in SER Section 3.3.2.3.12.

In LRA Table 3.3.2-15, the applicant stated that the copper-alloy tubing exposed to air-outdoor (external) is being managed for loss of material by the External Surfaces Monitoring Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that even though Revision 1 of the GALL Report did not address copper-alloy components exposed to outdoor air, Revision 2 of the GALL Report states that these components are subject to loss of material due to pitting and crevice corrosion. Based on its review of the GALL Report, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring Program acceptable because the visual inspections and surveillance activities included in the AMP are adequate to detect loss of material in the copper-alloy tubing prior to loss of intended function.

The staff's evaluation for steel bolting exposed to air-outdoor (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-15, the applicant stated that the copper-alloy bolting exposed to air-indoor uncontrolled (external) is being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because GALL Report AMP XI.M18, "Bolting Integrity," indicates that a loss of preload is an aging effect that is monitored for bolting materials. However, the staff noted that the applicant's LRA Table 3.0-1 indicates that air-indoor environment may contain some amount of moisture or contaminants, and, as such, there could be a potential for loss of material due to pitting and crevice corrosion and cracking. The loss of material and cracking aging effects are the subject of RAI 3.3.2-3, as discussed below. Thus, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts to verify that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

The staff noted that this material and environment combination is identified in the GALL Report, item VII.H2-9, which addresses copper alloy components exposed to fuel oil, and recommends GALL Report AMP XI.M30, "Fuel Oil Chemistry," and XI.M32, "One-Time Inspection" to manage loss of material; however the applicant has identified this additional aging effect. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material and environment combination in AMR items in LRA Tables 3.3.2-15 and 3.3.2-30.

The staff's evaluation of the applicant's Fuel Oil Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.2.9 and 3.0.3.2.11. The staff finds the applicant's proposal to manage aging using the Fuel Oil Chemistry and One-Time Inspection Programs acceptable because the Fuel Oil Chemistry Program will monitor and control the presence of contaminants in the fuel oil to preserve an environment that is not conducive to cracking, and the One-Time Inspection Program includes inspection techniques capable of verifying that cracking is not occurring. In LRA Tables 3.3.2-15 and 3.3.2-30, the applicant stated that for copper alloy with greater than 15 percent Zn tubing and valve bodies exposed to air-indoor uncontrolled (external) and air (internal), there are no AERMs, and no AMP is proposed. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that in LRA Table 3.0-1, "Process Environments," air is defined as an air environment containing some amount of moisture or contaminants. The staff also noted that loss of material, selective leaching, and cracking can occur in copper alloy with greater than 15 percent Zn components exposed to air, depending on the presence of contaminants and moisture. The GALL Report states that condensation on the surfaces of systems at temperatures below the dew point is considered "raw water" due to the potential for internal or external surface contamination. By letter dated May 2, 2011, the staff issued RAI 3.3.2-3 requesting that the applicant state why the specific environments—air-indoor uncontrolled (external) and air (internal)—will not induce loss of material, selective leaching, or cracking in copper alloys.

In its response dated June 3, 2011, the applicant stated that the indoor air environment was evaluated as uncontrolled, but systems with external surface temperatures the same as or greater than ambient were evaluated as dry surfaces. Surfaces below ambient temperatures were evaluated with a condensation environment. The applicant also stated that its indoor air does not contain detectable amounts of ammonia, ammonia salts, or sulfur dioxide. The applicant further stated that the internal air environment in the SBODG system (LRA Table 3.3.2-30) is not a wetted environment because the air is reliably dry such that condensation is only expected in specific locations within the system. Additionally, the areas where moisture is expected to accumulate are evaluated as being exposed to condensation, not air. The staff reviewed the applicant's response and noted that the GALL Report, Revision 2, item VII.J.AP-144, states that copper-alloy components exposed internally to indoor uncontrolled air have no AERM. The staff finds the applicant's response, and its proposal that these components have no AERMs, acceptable for the following reasons:

- The air environment is not expected to contain moisture or contaminants that could cause aging.
- The applicant evaluated those locations where moisture accumulation could occur and is managing those locations for exposure to condensation.
- The components are being managed consistent with the recommendations in the GALL Report for copper-alloy components exposed internally to indoor uncontrolled air.

The staff's concern described in RAI 3.3.2-3 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.16 Auxiliary Systems—Gaseous Radwaste System—Aging Management Review Results—LRA Table 3.3.2-16

In LRA Table 3.3.2-16, the applicant stated there is a TLAA for stainless steel orifice, piping, tubing, and valve bodies exposed to gas, which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.3.1, for this component and material. The staff's evaluation of the TLAA for non-Class 1 piping and in-line components is documented in SER Section 4.3.3.1.2.

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

3.3.2.3.17 Auxiliary Systems—Instrument Air System—Aging Management Review Results—LRA Table 3.3.2-17

The staff's evaluation for stainless steel piping, strainer bodies, strainer screens, tubing and valve bodies exposed to air (internal or external), for which the applicant stated there is no aging effect, proposed no AMP, and cited generic note G, is documented in SER Section 3.3.2.3.12.

3.3.2.3.18 Auxiliary Systems—Makeup and Purification System—Aging Management Review Results—LRA Table 3.3.2-18

In LRA Table 3.3.2-18, the applicant stated that copper alloy greater than 15 percent Zn heat exchanger tubes exposed to lubricating oil will be managed for reduction of heat transfer by the Lubricating Oil analysis and One-Time Inspection Programs. The AMR items cite generic note H, which states that the GALL Report does not address an aging effect for this component, environment, and material.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environmental combination because the addition of impurities, including water, into a lube oil system can lead to a reduction in heat transfer of copper-alloy heat exchanger tubes due to fouling. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of heat transfer through periodic monitoring and control of contaminants, including water. The staff's evaluation of the applicant's Lube Oil Analysis and One-Time Inspection Programs are documented in SER Section 3.0.3.1.13 and 3.0.3.2.11, respectively.

The staff finds the applicant's proposal to manage aging using the One-Time Inspection Program and the Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to provide verification of the effectiveness of the Lubricating Oil Analysis Program to manage reduction in heat transfer in copper-alloy heat exchanger tubes.

In LRA Table 3.3.2-18, the applicant stated that for air volume tanks exposed to dried air (internal), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G. Items associated with air volume tanks in Tables 3.3.2-18 cite plant-specific note 0318, which states that there are no AERMs because the applicant's Air Quality Monitoring Program will ensure that the control air environment supplied from the instrument air system remains dry and free of contaminants.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that, even though aluminum exposed to dried air is not specifically addressed, the GALL Report, item V.F-2, states that aluminum components exposed to indoor air uncontrolled (internal/external) have no aging effects or mechanisms, and no AMP is recommended. The staff considers dried air to be comparable to the indoor air uncontrolled environment since moisture would not be available to cause degradation, such as loss of material due to pitting.

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for copper-alloy components with greater than 15 percent Zn exposed to closed-cooling water, which are being managed for cracking by the Closed Cooling Water Chemistry Program citing generic note H, is documented in SER Section 3.3.2.3.12.

In LRA Table 3.3.2-18, the applicant stated that the stainless steel heat exchanger tubes for the seal return coolers (DB-E26-1 & 2) exposed to treated borated water greater than 140 °F (60 °C) (internal) are being managed for loss of heat transfer due to fouling by the PWR Water Chemistry and One-Time Inspection Programs. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in GALL Report, item VII.E1-9, which addresses stainless steel non-regenerative heat exchanger tubes exposed to treated borated water greater than 140 °F, and it recommends the PWR Water Chemistry Program to manage cracking and further evaluation of a plant-specific program to verify the absence of cracking. The staff also noted that the applicant identified the additional aging effect of loss of heat transfer. The staff further noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-18.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff noted that the applicant's PWR Water Chemistry Program includes periodic sampling and control of water chemistry parameters to maintain contaminants within acceptable limits to prevent loss of heat transfer. The staff also noted that the applicant's One-Time Inspection Program includes determination of a representative sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience using examination techniques such as volumetric or surface examinations. The staff finds the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs acceptable because the programs include activities to prevent loss of heat transfer and inspections to confirm loss of heat transfer is not occurring.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.19 Auxiliary Systems—Makeup Water Treatment System—Aging Management Review Results—LRA Table 3.3.2-19

In LRA Tables 3.3.2-19 and 3.3.2-21, the applicant stated that copper alloy greater than 15 percent Zn strainer bodies and tubing internally exposed to raw water are being managed for cracking by the Collection, Drainage, and Treatment Components Inspection Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, which addresses copper alloy and copper alloy greater than 15 percent Zn components exposed to raw water and recommends that they be managed for loss of material, reduction of heat transfer, and selective leaching; however, based on plant-specific experience, the applicant has identified this additional aging effect of cracking. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in AMR items in LRA Tables 3.3.2-14, 3.3.2-19, and 3.3.2-21.

The staff's evaluation of the Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the applicant's program is a new plant-specific program that uses enhanced visual inspection to detect cracking based on opportunity when surfaces are accessible during maintenance, repair, or surveillance. The staff finds the applicant's proposal to manage aging using the Collection, Drainage, and Treatment Components Inspection Program acceptable because enhanced visual inspections are capable of detecting cracking.

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 addressed in the GALL Report. The staff finds 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).

3.3.2.3.20 Auxiliary Systems—Miscellaneous Building HVAC System—Aging Management Review Results—LRA Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20, which summarizes the results of AMR evaluations for the miscellaneous building HVAC system component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.21 Auxiliary Systems—Miscellaneous Liquid Radwaste System—Aging Management Review Results—LRA Table 3.3.2-21

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for copper-alloy components with greater than 15 percent Zn exposed to raw water and being managed for cracking by the Collection, Drainage, and Treatment

Components Inspection Program, citing generic note H, is documented in SER Section 3.3.2.3.19.

In LRA Tables 3.3.2-21, 3.3.2-31 and Table 3.3.2-25 discussed in a letter dated April 15, 2011, the applicant stated that stainless steel piping, piping components and piping elements, and tanks internally exposed to raw water are being managed for cracking by the Collection, Drainage, and Treatment Components Inspection Program. The AMR items cite generic note H. Items associated with stainless steel components in LRA Tables 3.3.2-21, 3.3.2-25, and 3.3.2-31 cite plant-specific notes 316 and 330, which state that cracking due to SCC and IGA is an AERM for components with a normal operating temperature above 140 °F.

The staff noted that this material and environment combination is identified in the GALL Report, which addresses stainless steel components exposed to raw water and recommends managing loss of material and reduction of heat transfer; however, based on plant-specific experience, the applicant has identified this additional aging effect of cracking. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in AMR items in LRA Tables 3.3.2-1, 3.3.2-21, and 3.3.2-31.

The staff's evaluation of the Collection, Drainage, and Treatment Components Inspection Program is documented in SER Section 3.0.3.3.3. The staff noted that the applicant's program is a new plant-specific program that uses enhanced visual inspection to detect cracking. The staff finds the applicant's proposal to manage aging using the Collection, Drainage, and Treatment Components Inspection Program acceptable because the enhanced visual inspections are capable of detecting cracking.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR result of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds 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).

3.3.2.3.22 Auxiliary Systems—Nitrogen Gas System—Aging Management Review Results—LRA Table 3.3.2-22

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

3.3.2.3.23 Auxiliary Systems—Process and Area Radiation Monitoring System—Aging Management Review Results—LRA Table 3.3.2-23

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

3.3.2.3.24 Auxiliary Systems—Reactor Coolant Vent and Drain System—Aging Management Review Results—LRA Table 3.3.2-24

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

3.3.2.3.25 Auxiliary Systems—Sampling System—Aging Management Review Results—LRA Table 3.3.2-25

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel components exposed to raw water and being managed for cracking by the Collection, Drainage, and Treatment Components Inspection Program citing generic note H is documented in SER Section 3.3.2.3.21.

3.3.2.3.26 Auxiliary Systems—Service Water System—Aging Management Review Results—LRA Table 3.3.2-26

The staff's evaluation for steel bolting exposed to air-outdoor (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for steel bolting exposed to condensation (external), which is being managed for loss of preload and cracking by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

In LRA Table 3.3.2-26, the applicant stated that the stainless steel bolting exposed to condensation (external) is being managed for loss of preload and cracking by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Table IX.C states that stainless steels are susceptible to loss of material due to pitting and crevice corrosion and cracking due to SCC. GALL Report AMP XI.M18, “Bolting Integrity,” indicates that a loss of preload is an aging effect that is monitored for bolting materials. The loss of material aging effect is addressed in other AMR items. Thus, the aging effects of concern are loss of preload and cracking, which are addressed in the AMR.

The staff’s evaluation of the applicant’s Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant’s proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts to verify that the aging effect, loss of preload and cracking, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

The staff’s evaluation for gray cast iron valve body exposed to condensation (external), which is being managed for loss of material by the Selective Leaching Inspection Program and cites generic note G, is documented in SER Section 3.3.2.3.2.

In LRA Tables 3.3.2-26 and 3.3.2-27, the applicant stated that the steel and stainless steel piping and pump casing components exposed to moist air (internal and external) are being managed for loss of material by the One-Time Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that GALL Report, item VII.G.A-23, states that steel piping, piping components, and piping elements exposed to moist air are susceptible to loss of material; therefore, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination

The staff’s evaluation of the applicant’s One-Time Inspection Program is documented in SER Section 3.0.3.1.11. The GALL Report recommends that the loss of material aging effect for steel components exposed to moist air be managed by GALL Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.” However, in LRA Tables 3.3.2-26 and 3.3.2-27, the applicant instead proposed to use its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant stated that the One-Time Inspection Program is still credited to confirm the absence of aging effects at the air-water interface when an appropriate program is being used to manage the surface below the air-water interface and a periodic program is being used to manage the surface above the air-water interface. The staff reviewed the LRA and noted that for the steel pump casings in LRA Table 3.3.2-26, the surface above the air-water interface is being managed by the External Surfaces Monitoring Program, and the surface below the air-water interface is being managed by the Open-Cycle Cooling Water System Program. However, the staff also noted that for the stainless steel piping in LRA Table 3.3.2-27, the surface above the air-water interface is exposed to indoor uncontrolled air or air with borated water leakage, which has no AERM, and the surface below the air-water interface is being managed by the PWR Water Chemistry and One-Time Inspection Programs.

In its response letter dated September 16, 2011, concerning air-water and above-air interface aging management, the applicant revised these AMR items as part of an extent of condition review. The applicant revised the LRA to define that the moist air (internal) environment encompasses both the air-water interface and the air environment above the interface, and credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program to manage loss of material (except for selective leaching) and cracking for these steel components exposed to a moist air environment.

The staff reviewed the LRA changes and confirmed that for the steel pump casings in LRA Table 3.3.2-26, the air-water and above interface is now managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. However, the staff noted that for Table 3.3.2-26, row No. 83, for the steel service water pump casing (DB-P3-1, 2 & 3) and for Table 3.3.2-27, row No. 38, for stainless steel piping, the environment was changed to a moist air (internal) environment from a moist air (external) environment. In a subsequent applicant response dated October 7, 2011, the applicant revised these AMR items to return the environment to moist air (external) as they had previously been identified in the LRA.

During the review of the applicant's extent of condition review in a letter dated September 16, 2011, the staff questioned whether the stainless steel piping exposed to an air-indoor uncontrolled (internal) environment in LRA Table 3.3.2-27, rows 25 and 32, should also be included in the extent of condition review. In a teleconference held September 29, 2011, the applicant stated that these items are not subject to an air-water interface and are not part of the extent of condition review. By letter dated October 7, 2011, the applicant stated that the AMR items discussed on September 29, 2011, are not associated with an air-water interface.

The staff finds the applicant's response and its proposal to manage aging at and above the air-water interface using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable because it is consistent with the GALL Report recommendations for managing steel and stainless steel components exposed to moist air. The staff's concern described in RAI 3.2.2.1.26-1 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.27 Auxiliary Systems—Spent Fuel Pool Cooling and Cleanup System—Aging Management Review Results—LRA Table 3.3.2-27

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel piping components exposed to moist air, which are being managed for loss of material by the One-Time Inspection Program citing generic note G, is documented in Section 3.3.2.3.26.

3.3.2.3.28 Auxiliary Systems—Spent Resin Transfer System—Aging Management Review Results—LRA Table 3.3.2-28

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

As amended by letter dated June 3, 2011, in response to RAI 3.3.2.2.13-1, the applicant revised Table 3.3.2-28 to add elastomer flexible connections in a treated water greater than 60 °C (greater than140 °F) internal environment with an aging effect of loss of material due to wear and credited the new plant-specific Inspection of Internal Surface in Miscellaneous Piping and Ducting Program to manage the aging effect. The applicant cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, Section VII.A4, which addresses elastomer components exposed to treated water and recommends a plant-specific AMP to manage the aging effect of hardening and loss of strength. However, the applicant identified this additional aging effect. The applicant addressed the GALL Report identified aging effect for this component, material, and environment combination in AMR items in LRA Table 3.3.2-28. GALL Report, Revision 2, credited the Inspection of Internal Surface in Miscellaneous Piping and Ducting Program for the same material, environment, and aging effect combination.

The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program is documented in SER Section 3.0.3.3.7. The staff finds the applicant's proposal to manage loss of material of elastomer flexible connections in a treated water greater than 60 °C (greater than 140 °F) internal environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable because the new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program includes visual and physical (manipulation or prodding) examination of subject non-metallic, flexible (elastomeric) components in various environments for evidence of loss of material due to wear.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR result of material, environment, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.29 Auxiliary Systems—Station Air System—Aging Management Review Results—LRA Table 3.3.2-29

The staff's evaluation for copper-alloy (greater than 15 percent Zn) tubing exposed to condensation (external), which is being managed for loss of material by the Selective Leaching Inspection Program and cites generic note G, is documented in SER Section 3.3.2.3.2.

In LRA Table 3.3.2-29, as amended by letter dated May 24, 2011, the applicant stated that the polymer filter housings exposed externally to uncontrolled indoor air are being managed for hardening and loss of strength by the External Surfaces Monitoring Program. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that polymers can either be rigid, like polyvinyl chloride (PVC), or flexible, like elastomers. The GALL Report states that PVC exposed to indoor air has no aging effects requiring management and that elastomers exposed to indoor air can experience hardening and loss of strength. The staff also noted that filter housings are typically constructed of rigid polymers, similar to PVC, and that rigid polymers are resistant to aging effects when exposed to indoor air. Based on its review of the GALL Report, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring Program acceptable because, while no aging of the polymeric filter housing is expected, the periodic visual inspections in the External Surfaces Monitoring Program are capable of identifying hardening and loss of strength, as well as loss of material, cracking, and discoloration and, therefore, are capable of detecting any degradation prior to loss of intended function.

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 addressed in the GALL Report. The staff finds 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).

3.3.2.3.30 Auxiliary Systems—Station Blackout Diesel Generator System—Aging Management Review Results—LRA Table 3.3.2-30

The staff's evaluation for aluminum valve bodies and filter bodies exposed to air (internal), which cite generic note G, is documented in Section 3.3.2.3.12.

The staff's evaluation for copper alloy with greater than 15 percent Zn valve bodies exposed to fuel oil which are being managed for cracking by the Fuel Oil Chemistry and One-Time Inspection Programs and cite generic note H is documented in SER Section 3.3.2.3.15.

In LRA Table 3.3.2-30, the applicant stated there is a TLAA for stainless steel flexible connections and steel tubing, piping, silencer, and valve bodies exposed to diesel exhaust and steel piping exposed to air, which cite generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3.3.1, for this component and material. The staff's evaluation of the TLAA for non-Class 1 piping and in-line components is documented in SER Section 4.3.3.1.2.

The staff's evaluation for copper-alloy heat exchanger cooling coil tubes and aluminum heat exchanger cooling fins exposed to air-outdoor (external), which are being managed for reduction in heat transfer by the External Surfaces Monitoring Program and cite generic note G or H, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for steel bolting exposed to air-outdoor (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note H, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for stainless steel piping, strainer bodies, strainer screens, tubing, and valve bodies exposed to air (internal or external)—for which the applicant stated there is no aging effect, proposed no AMP, and cited generic note G—is documented in SER Section 3.3.2.3.12.

The staff's evaluation for copper-alloy components with greater than 15 percent Zn exposed to closed-cooling water, which are being managed for cracking by the Closed Cooling Water Chemistry Program citing generic note H, is documented in SER Section 3.3.2.3.12.

The staff's evaluation for copper alloy and copper alloy with greater than 15 percent Zn heat exchanger tubes, piping, tubing and valve bodies exposed to outdoor air (external or internal), which cite generic note G, is documented in Section 3.3.2.3.1.

The staff's evaluation for copper alloy with greater than 15 percent Zn tubing and valve bodies exposed to air-indoor uncontrolled (external) and air (internal), which cite generic note G, is documented in Section 3.3.2.3.15.

The staff's evaluation for copper alloy greater than 15 percent Zn heat exchanger components exposed to air-outdoor, which are being managed for reduction in heat transfer by the One-Time Inspection Program citing generic note H, is documented in Section 3.3.2.3.12.

3.3.2.3.31 Auxiliary Systems—Station Plumbing, Drains, and Sumps System—Aging Management Review Results—LRA Table 3.3.2-32

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.3.2.3.4.

The staff's evaluation for gray cast iron piping exposed to condensation (external) or moist air (internal), which is being managed for loss of material by the Selective Leaching Inspection Program and cites generic note G, is documented in SER Sections 3.3.2.3.2 and 3.3.2.3.14.

The staff's evaluation for gray cast iron piping exposed to moist air (internal), which is being managed for loss of material by the Selective Leaching Inspection Program and cites generic note G, is documented in SER Sections 3.3.2.3.2 and 3.3.2.3.14.

The staff's evaluation for stainless steel components exposed to raw water and being managed for cracking by the Collection, Drainage, and Treatment Components Inspection Program citing generic note H is documented in SER Section 3.3.2.3.21.

3.3.2.3.32 Auxiliary Systems—Turbine Plant Cooling Water System—Aging Management Review Results—LRA Table 3.3.2-32

The staff reviewed LRA Table 3.3.2-32, which summarizes the results of AMR evaluations for the turbine plant cooling water system component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.3 Conclusion

The staff concludes that the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion system components and component groups of the following systems:

- AFW system
- condensate storage system
- MFW system
- main steam system

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the steam and power conversion system components and component groups. In LRA Table 3.4.1, "Summary of Aging Management Programs for Steam and Power Conversion Systems Evaluated in Chapter VIII of NUREG-1801," 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 if 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 remain 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 identified the appropriate GALL Report AMRs. Details of the staff's evaluation are discussed in SER Sections 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 that the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR items and the plant's operating experience to verify the applicant's claims.

Table 3.4-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.4 and addressed in the GALL Report.

Table 3.4-1. Staff evaluation for steam and power conversion system components in the GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.4.2.2.1)
Steel piping, piping components, and piping elements exposed to steam (3.4.1-2)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.2(1))
Steel heat exchanger components exposed to treated water (3.4.1-3)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.2.(1))
Steel piping, piping components, and piping elements exposed to treated water (3.4.1-4)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.2(1))
Steel heat exchanger components exposed to treated water (3.4.1-5)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.4.2.2.9)

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 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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.2(1))
Steel piping, piping components, and piping elements exposed to lubricating oil (3.4.1-7)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.2(2))
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-8)	Loss of material due to general, pitting, crevice, and MIC and fouling	Plant-specific	Yes	Not applicable	Not applicable to Davis-Besse (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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.4(1))
Steel, stainless steel, and copper-alloy heat exchanger tubes exposed to lubricating oil (3.4.1-10)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.4(2))
Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil (3.4.1-11)	Loss of material due to general, pitting, crevice, and MIC	Buried Piping and Tank Surveillance or Buried Piping and Tank Inspection	No Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.2.5(1))
Steel heat exchanger components exposed to lubricating oil (3.4.1-12)	Loss of material due to general, pitting, crevice, and MIC	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.5(2))

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-13)	SCC	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.4.2.2.6)
Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water > 140 °F (> 60 °C) (3.4.1-14)	SCC	Water Chemistry and One-Time Inspection	Yes	PWR 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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.7(1))
Stainless steel piping, piping components, and piping elements; tanks; and heat exchanger components exposed to treated water (3.4.1-16)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.7(1))
Stainless steel piping, piping components, and piping elements exposed to soil (3.4.1-17)	Loss of material due to pitting and crevice corrosion	Plant-specific	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.2.7(2))
Copper-alloy piping, piping components, and piping elements exposed to lubricating oil (3.4.1-18)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.7(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 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 MIC	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis and One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.2.8)
Steel tanks exposed to air-outdoor (external) (3.4.1-20)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-21)	SCC and cracking due to cyclic loading	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Steel bolting and closure bolting exposed to air with steam or water leakage, air-outdoor (external), or air-indoor uncontrolled (external) (3.4.1-22)	Loss of material due to general, pitting, and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water > 140 °F (> 60 °C) (3.4.1-23)	SCC	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (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 Davis-Besse (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
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 Davis-Besse (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 Davis-Besse (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 Davis-Besse (see SER Section 3.4.2.1.1)
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 and Bolting Integrity	Consistent with GALL Report (see SER Section 3.4.2.1.1)
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 condensation (internal) or air-outdoor (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	One-Time Inspection	Consistent with GALL Report (see SER Section 3.4.2.1.2

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 heat exchanger components exposed to raw water (3.4.1-31)	Loss of material due to general, pitting, crevice, galvanic, and MIC and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.1.1)
Stainless steel and copper-alloy piping, piping components, and piping elements exposed to raw water (3.4.1-32)	Loss of material due to pitting, crevice, and MIC	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (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 MIC and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.1.1)
Steel, stainless steel, and copper-alloy heat exchanger tubes exposed to raw water (3.4.1-34)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.1.1)
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 Inspection	Consistent with GALL Report
Gray cast-iron piping, piping components, and piping elements exposed to soil, treated water, or raw water (3.4.1-36)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching Inspection	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, 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	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Sections 3.4.2.1.3 and 3.4.2.2.2)
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)	SCC	Water Chemistry	No	PWR Water Chemistry and One-Time Inspection	Consistent with GALL Report (see SER Sections 3.4.2.1.4 and 3.4.2.2.6)
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.1.1)
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	Not applicable	None Consistent with GALL Report	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air-indoor controlled (external) (3.4.1-42)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (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	Not applicable	Not applicable	Not applicable to Davis-Besse (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, stainless steel, aluminum, and copper-alloy piping, piping components, and piping elements exposed to gas (3.4.1-44)	None	None	Not applicable	Not applicable	Not applicable to Davis-Besse (see SER Section 3.4.2.1.1)

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 that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.4.2.2, discusses the staff's review of AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, discusses the staff's review of AMR results for components that the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the steam and power conversion system components is documented in SER Section 3.0.3.

As a result of Revision 2 to the SRP-LR and the GALL Report, there was a significant realignment of AMR items as follows:

- In some cases, changes were of an administrative nature (e.g., an identical material, environment, aging effect, and recommended program in Table 3.4-1of the SRP-LR was renumbered with no other changes).
- Technical changes were implemented for specific Table 3.4-1 items (e.g., component information clarified, changes to environment, added concrete attributes evaluation, clarified BWR and PWR applicability).
- Many SRP-LR further evaluation recommendations were eliminated, principally because Revision 2 implemented changes to GALL Report AMPs and AMR items resulting in the further evaluation being addressed. As an example, Revision 1 of the SRP-LR and GALL Report recommended a further evaluation of a plant-specific program to manage hardening and loss of strength of elastomeric components exposed to air-indoor uncontrolled. Revision 2 of the SRP-LR and GALL Report incorporated elastomeric components, including visual exams and manipulation of the material into GALL Report AMPs XI.M36, “External Surfaces Monitoring of Mechanical Components” and XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” thus eliminating the need for a plant-specific program.
- Revision 2 contains additional material, environment, and aging effect combinations, thus eliminating the need for citing generic notes F–J given that the applicant could now select a Table 3.4-1 that is consistent. For example, AMR item 3.4-53, which addresses copper-alloy (less than or equal to15 percent Zn and less than or equal to 8 percent Al) piping, piping components, and piping elements exposed to air with borated water leakage, was added.

In each instance, regardless of the type of change, the staff evaluated the Revision 1 technical requirements compared to the Revision 2 technical requirements and ensured that the applicant's LRA was evaluated against the current staff position as contained in Revision 2.

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion system components:

- Bolting Integrity Program
- Boric Acid Corrosion Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- PWR Water Chemistry Program
- Selective Leaching Inspection Program

LRA Tables 3.4.2-1 through 3.4.2-4 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 claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine if the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A–E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these 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 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 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 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 items to verify consistency with the GALL Report and determined whether the AMR item of the different component applied to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR item, although different from, 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 items to verify consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. 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 item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these AMR items to 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 AMR Results Identified as Not Applicable

For item 3.4.1-13 in LRA Table 3.4.1, the applicant claimed that the corresponding AMR item in the GALL Report is not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR, confirmed the item only apply to BWRs, and finds the item is not applicable to Davis-Besse.

For items 3.4.1-20, 3.4.1-23 through 3.4.1-27, 3.4.1-31 through 3.4.1-34, and 3.4.1-40 through3.4.1-44 in LRA Table 3.4.1, the applicant claimed that they were not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Davis-Besse. The staff reviewed the LRA and USAR and confirmed that the applicant's LRA does not have any AMR results that are applicable to these items.

For LRA Table 3.4.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable; however, the staff non-applicability verification of these items required the review of sources beyond the LRA and FSAR, and/or the issuance of RAIs.

LRA Table 3.4.1, item 3.4.1-42, addresses steel piping, piping components, and piping elements exposed to controlled indoor air (external) and states that there are no aging effects, aging mechanisms, or AMPs. The GALL Report, Table VIII, item VIII.1-13 (SP-1), recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group exposed to this environment. The applicant stated that this item is not applicable because all indoor air environments were conservatively evaluated as uncontrolled environments. The staff noted that, in place of item 3.4.1-42, the applicant applied LRA Table 3.4.1, item 3.4.1-28, which addresses steel external surfaces exposed to uncontrolled indoor air, outdoor air, and condensation, which are managed for loss of material due to general corrosion by the External Surfaces Monitoring Program. The staff evaluated the applicant's claim and found it acceptable because the applicant's decision to consider indoor air environments as uncontrolled is a reasonable approach to ensure that loss of material due to general corrosion will be adequately managed during the period of extended operation.

3.4.2.1.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.4.1, item 3.4.1-30, addresses steel piping and piping components exposed to condensation (internal), which are being managed for loss of material due to general, pitting, and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the One-Time Inspection Program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to ensure that these aging effects are adequately managed.

For those items associated with generic note E, GALL Report AMP XI.M38 recommends using visual inspections performed by personnel qualified in accordance with site controlled procedures and processes to manage aging. In its review of components associated with item 3.4.1-30, for which the applicant cited generic note E, the staff noted that the applicant intends to use a One-Time Inspection Program to manage aging. The GALL Report states that one-time inspections are only appropriate when an aging effect is not expected or is expected to occur very slowly, neither of which are true to steel components exposed to condensation. It is not clear to the staff why the applicant proposed to use its One-Time Inspection Program. By letter dated April 20, 2011, the staff issued RAI 3.3.2.71-2 requesting that the applicant provide details of a program to adequately manage these materials and environmental combinations.

In its response dated May 24, 2011, the applicant stated that the aging of steel and gray cast iron piping, piping components, and piping elements exposed to air (including air-indoor uncontrolled and air-outdoor), condensation, diesel exhaust, or moist air, and external cooling coil surfaces will be managed by its new plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The applicant also stated that the plant-specific Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program will include opportunistic inspections when components are opened for maintenance, repair, or surveillance. The applicant further stated that during its review of these components, the environment was re-evaluated and the components were re-assigned environments of steam or treated water in order to provide a more accurate aging evaluation because the components are exposed to condensed steam, not condensation. As a result, the AMR items that reference item 3.4.1-30 were deleted and item 3.4.1-30 was revised to be not applicable. The staff finds the applicant's response acceptable because steam or treated water are applicable environments for components exposed to condensed steam, the components are being managed for aging as part of their newly assigned material and environment combinations in other AMR items, and the staff's review of the LRA and UFSAR confirmed that there are no other steel components exposed internally to condensation or outdoor air in the steam and power conversion systems. The staff's concern described in RAI 3.3.2.71-2 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain 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 3.4.1, item 3.4.1-37, addresses steel, stainless steel and nickel-based alloy piping, piping components, and piping elements exposed to steam, which are being managed for loss of material due to pitting and crevice corrosion. The staff noted that the applicant also applied this item to steel and stainless steel heat exchanger components. The LRA credits the PWR Water Chemistry and One-Time Inspection Programs to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M2, “Water Chemistry,” to ensure that these aging effects are adequately managed. The AMR items associated with the One-Time Inspection Program cite generic note E.

For these items, GALL Report AMP XI.M2 recommends using water chemistry controls to manage the aging. In its review of components associated with item 3.4.1-37, the staff noted that the PWR Water Chemistry and One-Time Inspection Programs propose to manage the aging of steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements and steel and stainless steel heat exchanger components through the use of water chemistry controls and a one-time visual inspection to verify the effectiveness of the PWR Water Chemistry Program.

The staff’s evaluations of the applicant’s PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.4.1-37, the staff finds the applicant’s proposal to manage aging using the PWR Water Chemistry Program and the One-Time Inspection Program acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and identifies the actions required if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion, consistent with the recommendations of the GALL Report, Revision 2.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.1.4 Cracking Due to Stress Corrosion Cracking

LRA Table 3.4.1, item 3.4.1-39, addresses stainless steel piping, piping components, and piping elements exposed to steam, which are being managed for cracking due to SCC. The LRA credits the PWR Water Chemistry Program to manage the aging effect. In addition, the applicant credits the One-Time Inspection Program to confirm the effectiveness of the PWR Water Chemistry Program for adequate aging management of cracking. The GALL Report recommends GALL Report AMP XI.M2, “Water Chemistry,” to ensure that these aging effects are adequately managed. The associated AMR items cite generic note E.

For those items associated with generic note E, GALL Report AMP XI.M2 recommends using preventive measures, including water chemistry controls, to manage the aging of these AMR items. In its review of components associated with item 3.4.1-39, for which the applicant cited generic note E, the staff noted that the PWR Water Chemistry Program proposes managing the aging of stainless steel piping, piping components, and piping elements through the use of preventive measures, including water chemistry controls, while the One-Time Inspection Program includes a one-time inspection to confirm the effectiveness of the PWR Water Chemistry Program to manage cracking.

The staff’s evaluations of the applicant’s PWR Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively.

In its review of the components associated with item 3.4.1-39, the staff finds the applicant's proposal to manage aging using the PWR Water Chemistry Program and One-Time Inspection Program acceptable because the PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging and includes the actions that will be performed if the parameters exceed the limits. Additionally, the One-Time Inspection Program includes a one-time inspection of select components to confirm the effectiveness of the PWR Water Chemistry Program so that it is ensured to adequately manage the aging effect due to SCC of the components.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results 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, and 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
- 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 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, associated with LRA Table 3.4.1, item 3.4.1-1, addresses steel piping, piping components, and piping elements exposed to steam or treated water being managed for cumulative fatigue damage. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, and is required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that the TLAA identified for the steam and power conversion systems is addressed separately in LRA Section 4.3.

The staff reviewed LRA Section 3.4.2.2.1 against the criteria in SRP-LR Section 3.4.2.2.1, which state that fatigue of steam and power conversion system components is a TLAA, as defined in 10 CFR 54.3, and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements in 10 CFR 54.21(c)(1) and in accordance with SRP-LR

Section 4.3, “Metal Fatigue Analysis.” The staff reviewed the applicant’s AMR items and finds that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage in steel piping, piping components, and piping elements exposed to steam or treated water, except as identified below.

In its review of the applicant’s metal fatigue AMR assessment (item 3.4.1-1) in the steam and power conversion systems, the staff also identified that the applicant did not include the applicable AMR items in LRA Table 3.4.2-x for the TLAAs associated with fatigue of non-Class 1 piping and in-line components. The staff noted that LRA Section 4.3.3.1 discusses the TLAAs associated with fatigue of non-Class 1 piping and in-line components and states that these TLAAs will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). Therefore, as part of RAI 3.2.2.2.1-1 issued on May 2, 2011, the staff requested that the applicant justify this discrepancy. The details of RAI 3.2.2.2.1-1 and the staff’s evaluation of the applicant’s response are documented in SER Section 3.2.2.2.1. As documented in SER Section 3.2.2.2.1 the staff finds the applicant's response to RAI 3.2.2.2.1-1 to be acceptable; therefore, the staff's concern described in RAI 3.2.2.2.1-1 is resolved.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.4.2.2.1 criteria. For those AMR items that apply to LRA Section 3.4.2.2.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). SER Section 4.3 documents the staff’s review of the applicant’s evaluation of the TLAA for these components.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.2 against the following criteria in SRP-LR Section 3.4.2.2.2:

(1) LRA Section 3.4.2.2.2.1, associated with LRA Table 3.4.1, items 3.4.1-2, 3.4.1-3, 3.4.1-4, and 3.4.1-6, addresses steel (and gray cast iron) piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and steam, which are being managed for loss of material due to general, pitting, and crevice corrosion by the PWR Water Chemistry and One-Time Inspection Programs. The staff noted that the applicant addressed steel piping, piping components, and piping elements exposed to steam in the main steam system with LRA Table 3.4.1, item 3.4.1-37, which is discussed in SER Section 3.4.2.1.3. The staff also noted that the applicant addressed stainless steel tanks exposed to treated water with LRA Table 3.4.1, item 3.4.1-16, which is discussed in SER Section 3.4.2.2.7.1. The criteria in SRP-LR Section 3.4.2.2.2.1 states that loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and steel piping, piping components, and piping elements exposed to steam. The SRP-LR also states that the Water Chemistry Program relies on monitoring and control of water chemistry to mitigate degradation, and a one-time inspection of select 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 addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to general, pitting, and crevice corrosion of steel and gray cast iron piping, piping components, piping elements, tanks, and heat exchanger components exposed to

treated water and steam will be managed by the PWR Water Chemistry and One-Time Inspection Programs.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with items 3.4.1-2, 3.4.1-3, 3.4.1-4, and 3.4.1-6, the staff finds that the applicant met the further evaluation criteria. The staff finds that the applicant's proposal to manage loss of material using the PWR Water Chemistry and One-Time Inspection Programs is acceptable because the PWR Water Chemistry Program uses chemical sampling and corrective actions to ensure that impurities are minimized to reduce aging due to loss of material, and the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion, consistent with the recommendations in the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2.1, criteria. For those items that apply to LRA Section 3.4.2.2.2.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.4.2.2.2.2, associated with LRA Table 3.4.1, item 3.4.1-7, addresses steel piping, piping components, piping elements, and tanks that are exposed to lubricating oil in the steam and power conversion systems, which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.4.2.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.2, which states that loss of material due to general, pitting, and crevice corrosion, could occur for steel piping, piping components, and piping elements exposed to lubricating oil.

The staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.4.1-7, the staff finds the applicant's proposal to manage aging using the One-Time Inspection and Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.4.2.2.2.2; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2.2, criteria. For the AMR items that apply to LRA Section 3.4.2.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Section 3.4.2.2.3, associated with LRA Table 3.4.1, item 3.4.1-08, addresses loss of material due to general, pitting, crevice, and MIC and fouling in steel piping, piping components, and piping elements exposed to raw water. The applicant stated that this item is not applicable because there is no steel piping, piping components, and piping elements exposed to raw water in the steam and power conversion system. The staff reviewed LRA Sections 2.3.4 and 3.4 and the USAR and confirmed that no in-scope steel piping, piping components, and piping elements exposed to raw water are present in the steam and power conversion system; therefore, it finds the applicant's claim acceptable.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4:

(1) LRA Section 3.4.2.2.4.1, associated with LRA Table 3.4.1, item 3.4.1-9, addresses stainless steel and copper heat exchanger tubes exposed to treated water, which are being managed for reduction of heat transfer due to fouling by the PWR Water Chemistry and the One-Time Inspection Programs. The criteria in SRP-LR Section 3.4.2.2.4.1, state 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 also states that although the existing AMP relies on control of water chemistry to manage this aging effect, the control of water chemistry may not always have been adequate to preclude fouling. The SRP-LR recommends that the effectiveness of the Water Chemistry Control Program be confirmed and states that a one-time inspection is an acceptable verification method.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.4.1-9, the staff finds that the applicant met the further evaluation criteria. The staff finds that the applicant's proposal to manage aging using the specified programs is acceptable because the PWR Water Chemistry Program includes control of detrimental contaminants below the levels known to cause fouling, and the One-Time Inspection Program will verify the effectiveness of the chemistry controls by inspecting a sample of similar components exposed to the same environment.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4.1 criteria. For those items that apply to LRA Section 3.4.2.2.4.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.4.2.2.4.2, associated with LRA Table 3.4.1, item 3.4.1-10, addresses steel, stainless steel, and copper-alloy heat exchanger tubes exposed to lubricating oil, which are being managed for reduction in heat transfer due to fouling by the Lubricating Oil Analysis Program. The applicant stated that the steam and power conversion systems do not contain steel or stainless steel heat exchanger tubes that are exposed to lubricating oil and subject to an AMR; however, fouling for copper-alloy (including copper alloy greater than 15 percent Zn) heat exchanger tubes that are exposed to lubricating oil is managed by the Lubricating Oil Analysis Program. Additionally, the applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage the reduction in heat transfer through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.4.2.2.4.2 against the criteria in SRP-LR Section 3.4.2.2.4.2, 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 staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.4.1-10, the staff finds the applicant's proposal to manage aging using the One-Time Inspection and Lubricating Oil Analysis Program acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used to verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.4.2.2.4.2; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4.2, criteria. For the AMR items that apply to LRA Section 3.4.2.2.4.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5:

(1) LRA Section 3.4.2.2.5.1, associated with LRA Table 3.4.1, item 3.4.1-11, addresses loss of material due to general, pitting, and crevice corrosion, and MIC in steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil. The applicant stated that this item is not applicable because there are no steel (with or without coating or wrapping) piping, piping components, or piping elements in the steam and power conversion systems that are exposed to soil. The staff reviewed LRA Sections 2.3.4 and 3.4 and the applicant's USAR and confirmed that no in-scope steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil are present in the steam and power conversion systems; therefore, it finds the applicant's claim acceptable.

(2) LRA Section 3.4.2.2.5. 2, associated with LRA Table 3.4.1, item 3.4.1-12, addresses steel heat exchanger components exposed to lubricating oil, which are being managed for loss of material due to general, pitting, crevice and MIC by the Lubricating Oil Analysis and One-Time Inspection Programs. The criteria in SRP-LR Section 3.4.2.2.5.2, state that loss of material due to general, pitting, crevice, and MIC may occur in steel heat exchanger tubes exposed to lubricating oil. The SRP-LR also states that the existing AMP controls lube oil chemistry to mitigate this aging effect and that the effectiveness should be confirmed because the control of lube oil chemistry may not be fully effective in precluding loss of material. The SRP-LR further states that a one-time inspection of selected components at susceptible locations is an acceptable method to verify the program's effectiveness. The applicant addressed the further evaluation criteria of the SRP-LR by stating that it will implement the One-Time Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material. The applicant further stated that loss of material due to selective leaching in gray cast iron heat exchanger components will also be managed by the Lubricating Oil Analysis and One-Time Inspection Programs.

The staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. In its review of components associated with item 3.4.1-12, the staff finds that the applicant met the further review criteria. The staff finds the applicant's proposal to manage aging using the specified AMPs acceptable because the Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, and the One-Time Inspection Program will verify the effectiveness of the Lubricating Oil Analysis Program to manage this aging effect. However, it was not clear to the staff how periodic sampling and analysis of lubricating oil as performed by the Lubricating Oil Analysis Program will manage loss of material due to selective leaching. GALL Report AMP XI.M33, "Selective Leaching of Materials," recommends visual inspection and hardness measurement or other mechanical examination techniques. By letter dated May 2, 2011, the staff issued RAI 3.4.2.2.5-1 requesting the applicant to justify how the Lubricating Oil Analysis Program will manage the aging effect of loss of material due to selective leaching.

In its response dated June 3, 2011, the applicant stated that the Lubricating Oil Analysis Program manages loss of material due to selective leaching by controlling the conditions necessary for the aging effect to occur, and revised LRA Sections A.1.26 and B.2.26 to include selective leaching as an aging effect being managed by the AMP. The applicant also stated that loss of material due to selective leaching is a slow-acting corrosion process, requiring long periods of exposure to pooled water, which is not expected to be present. The applicant further stated that any water detected in lubricating oil would be treated as a contaminant and would require additional evaluation using the applicant's Corrective Action Program as to whether selective leaching is occurring. The staff finds the applicant's response acceptable because the description of the Lubricating Oil Analysis Program was clarified to state that it manages selective leaching of susceptible components, and the applicant clarified that the determination of whether selective leaching is occurring will be made using its Corrective Action Program whenever water is detected. The staff's concern described in RAI 3.4.2.2.5-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.5.2, criteria. For those items that apply to LRA Section 3.4.2.2.5.2, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3)

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.5 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

LRA Section 3.4.2.2.6, associated with LRA Table 3.4.1, items 3.4.1-13 and 3.4.1-14, addresses stainless steel piping components and tanks exposed to treated water greater than 140 °F (60 °C), which are being managed for cracking due to SCC by the PWR Water Chemistry Program and the One-Time Inspection Program. The criteria in SRP-LR Section 3.4.2.2.6 state that cracking due to SCC could occur for stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 140 °F (60 °C). The SRP-LR also states that the existing AMP relies on monitoring and control of primary water chemistry. In addition, the SRP-LR states that high concentrations of impurities in crevices and locations of stagnant flow conditions could cause SCC; therefore, the GALL Report recommends that this aging issue be managed by a One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the PWR Water Chemistry Program effectiveness will be confirmed by the One-Time Inspection Program.

The applicant also stated that for LRA item 3.4.1-13 regarding the SCC of stainless steel components exposed to steam, the applicability of the item is limited to BWRs; therefore, the item is not applicable. The applicant further indicated that in relation with item 3.4.1-14, LRA item 3.4.1-39 addresses the aging management of the stainless steel piping, piping components, and piping elements in the steam and power conversion systems, which are exposed to steam. In addition, LRA item 3.4.1-39 indicates that the aging effect of stainless steel components exposed to steam is managed by the PWR Water Chemistry Program and the One-Time Inspection Program that will confirm the effectiveness of the PWR Water Chemistry Program to manage cracking. In its review, including a review of the guidance in SRP-LR, the staff finds that the applicant's proposal to use the PWR Water Chemistry Program and One-Time Inspection Program, as addressed in LRA item 3.4.1-39, is consistent with SRP-LR, Revision 2, Table 3.4-1, item 11; therefore, the applicant's AMR results related to LRA items 3.4.1-14 and 3.4.1-39 are acceptable.

The staff's evaluations of the applicant's PWR Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with item 3.4.1-14, the staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the PWR Water Chemistry Program and the One-Time Inspection Program is acceptable for the following reasons:

- The PWR Water Chemistry Program establishes the plant water chemistry control parameters and their limits to mitigate the environmental effect on the aging.
- The PWR Water Chemistry Program also includes the actions that will be performed if the parameters exceed the limits.
- The One-Time Inspection will be used to confirm the effectiveness of the PWR Water Chemistry Program, consistent with the GALL Report.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.6 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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 3.4.2.2.7.1, associated with LRA Table 3.4.1, items 3.4.1-15 and 3.4.1-16, addresses stainless steel, aluminum, and copper-alloy piping, piping components, piping elements, stainless steel tanks, and heat exchanger components exposed to treated water, which are being managed for loss of material due to pitting and crevice corrosion by the PWR Water Chemistry and One-Time Inspection Programs. The staff noted that the applicant also applied this item to copper-alloy heat exchanger components exposed to treated water. The criteria in SRP-LR Section 3.3.2.2.7.1, state that loss of material due to pitting and crevice corrosion could occur for stainless steel, aluminum, and copper-alloy piping, piping components, and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. The SRP-LR also states that the existing AMP relies on monitoring and control of water chemistry to mitigate degradation and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or progressing very slowly, such that the component's intended function will be maintained during the period of extended operation. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, piping elements, tanks, and heat exchanger components and copper-alloy heat exchanger components exposed to treated water will be managed by the PWR Water Chemistry and One-Time Inspection Programs.

    The applicant stated that for item 3.4.1-15, the applicability is limited to copper-alloy heat exchanger components exposed to treated water. The staff noted that a search of the applicant's USAR confirmed that no in-scope aluminum or copper-alloy piping, piping components, and piping elements exposed to treated water are present in the steam and power conversion systems.

The staff's evaluations of the applicant's PWR Water Chemistry and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. In its review of components associated with items 3.4.1-15 and 3.4.1-16, the staff finds that the applicant met the further evaluation criteria. The staff also finds that the applicant's proposal to manage aging using the PWR Water Chemistry and One-Time Inspection Programs is acceptable because (1) the PWR Water Chemistry Program uses chemical sampling and corrective actions to ensure that impurities are minimized to reduce aging due to loss of material, and (2) the One-Time Inspection Program includes visual, volumetric, and surface inspection techniques capable of detecting pitting and crevice corrosion, consistent with the recommendations in the GALL Report, Revision 2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7.1, criteria. For those items that apply to LRA Section 3.4.2.2.7.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.4.2.2.7.2, associated with LRA Table 3.4.1, item 3.4.1-17, addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to soil. The applicant stated that this item is not applicable because there are no stainless steel piping, piping components, or piping elements in the steam and power conversion systems that are exposed to soil. The staff reviewed LRA Sections 2.3.4 and 3.4 and the applicant's USAR and confirmed that no in-scope stainless steel piping, piping components, and piping elements exposed to soil are present in the steam and power conversion systems; therefore, it finds the applicant's claim acceptable.

(3) LRA Section 3.4.2.2.7.3, associated with LRA Table 3.4.1, item 3.4.1-18, addresses copper-alloy piping, piping components, piping elements and copper-alloy heat exchanger components exposed to lubricating oil, which are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis Program. Additionally, the applicant stated that this item is also applied to loss of material due to selective leaching for copper-alloy (copper alloy greater than 15 percent Zn) components that are exposed to lubricating oil. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to pitting and crevice corrosion through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.4.2.2.7.3 against the criteria in SRP-LR Section 3.4.2.2.7.3, which state 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 staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. On the basis of its review of components associated with item 3.4.1-18, the staff finds the applicant's proposal to manage aging using the One-Time Inspection and Lubricating Oil Analysis Programs acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.4.2.2.7.3; therefore, the applicant's AMR is consistent with the GALL Report.

However, it was not clear to the staff how periodic sampling and analysis of lubricating oil as performed by the Lubricating Oil Analysis Program will manage loss of material due to selective leaching. GALL Report AMP XI.M33, "Selective Leaching of Materials," recommends visual inspection and hardness measurement or other mechanical examination techniques. By letter dated May 2, 2011, the staff issued RAI 3.4.2.2.5-1 requesting the applicant to justify how the Lubricating Oil Analysis Program will manage the aging effect of loss of material due to selective leaching.

In its response dated June 3, 2011, the applicant stated that the Lubricating Oil Analysis Program manages loss of material due to selective leaching by controlling the conditions necessary for the aging effect to occur. In its response, the applicant revised LRA Sections A.1.26 and B.2.26 to include selective leaching as an aging effect being managed by the AMP. The applicant also stated that loss of material due to selective leaching is a slow-acting corrosion process, requiring long periods of exposure to pooled water, which is not expected to be present. The applicant further stated that any water detected in lubricating oil would be treated as a contaminant and would require additional evaluation using the applicant's Corrective Action Program as to whether selective leaching is occurring. The staff finds the applicant's response acceptable because the description of the Lubricating Oil Analysis Program was clarified to state that it manages selective leaching of susceptible components, and the applicant clarified that the determination of whether selective leaching is occurring will be made using its Corrective Action Program whenever water is detected. The staff's concern described in RAI 3.4.2.2.5-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7.3, criteria. For items that apply to LRA Section 3.4.2.2.7.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7 criteria. For those AMR 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 demonstrated that the effects of aging will be adequately managed so that the intended functions will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Section 3.4.2.2.8, associated with LRA Table 3.4.1, item 3.4.1-19, addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil, which are being managed for loss of material due to pitting, crevice, and MIC by the Lubricating Oil Analysis Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program will also be used to verify the effectiveness of the Lubricating Oil Analysis Program to manage loss of material due to pitting and crevice corrosion through periodic monitoring and control of contaminants, including water.

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8, which state 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.

The staff's evaluations of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11, respectively. On the basis of its review of components associated with item 3.4.1-19, the staff finds the applicant's proposal to manage aging using the One-Time Inspection and Lubricating Oil Analysis Programs acceptable because the Lubricating Oil Analysis Program was determined to be consistent with the GALL Report, and the applicant stated that the One-Time Inspection Program will be used verify the effectiveness of the Lubricating Oil Analysis Program. This satisfies the acceptance criteria in SRP-LR Section 3.4.2.2.8; therefore, the applicant's AMR is consistent with the GALL Report.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.8 criteria. For those AMR 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 demonstrated that the effect of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

LRA Section 3.4.2.2.9 is associated with LRA Table 3.4.1, item 3.4.1-5, and addresses loss of material due to general, pitting, crevice and galvanic corrosion in steel heat exchanger components exposed to treated water. The applicant stated that this AMR item is not applicable because it is applicable to BWR plants only. The staff reviewed LRA Section 3.4 and noted that, contrary to the applicant's statement, there are steel heat exchanger components exposed to treated water in the steam and power conversion systems. The staff noted, however, that the applicant aligned these heat exchanger components to item 3.4.1-3, which addresses the same aging effect for similar components in treated water in PWRs. The staff also noted that these items are the subject of SRP-LR Section 3.4.2.2.2, item 1, and the further evaluation criteria are identical. The staff further noted that the SRP-LR, item 3.4.1-5, is for BWR components; therefore, it finds the applicant's claim, that this item is not applicable, acceptable.

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.4.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-4, 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 3.4.2-1 through 3.4.2-4, the applicant indicated, via notes F–J, that the combination of component type, material, environment, and AERM does not correspond to an

AMR 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 item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the AMR item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the AMR 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 if the applicant demonstrated that the aging effects will be adequately managed so that the intended function(s) will remain 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 Systems—Auxiliary Feedwater System—Aging Management Review Results—LRA Table 3.4.2-1

In LRA Tables 3.4.2-1 and 3.4.2-4, the applicant stated that the stainless steel bolting exposed to air with steam or water leakage (external) is being managed for loss of material and cracking by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because GALL Report Table IX.C states that stainless steels are susceptible to loss of material due to pitting and crevice corrosion and cracking due to SCC. GALL Report AMP XI.M18, "Bolting Integrity," indicates that a loss of preload is an aging effect that is monitored for bolting materials. The loss of preload is the subject of RAI B.2.4-4, as discussed in SER Section 3.2.2.3.1. Thus, the aging effects of concern are loss of material and cracking, which are addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because it will use periodic visual inspections that would detect loss of material and cracking prior to loss of component intended function.

In LRA Tables 3.4.2-1 and 3.4.2-4, the applicant stated that the stainless steel bolting exposed to air-indoor uncontrolled (external) is being managed for loss of preload by the Bolting Integrity Program. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environmental combination because even though stainless steel bolting exposed to air-indoor is not specifically addressed in the GALL Report, Table IX.E of the GALL Report states that loss of preload can occur independent of environmental conditions because it can be caused by thermal or mechanical effects. Additionally, Table IX.C of the GALL Report states that stainless steel material is susceptible to a variety of aging effects and mechanisms, including loss of material due to pitting and crevice corrosion and cracking due to SCC. The staff noted that the environment of interest, air-indoor, would not induce SCC or loss of material in stainless steel material because stainless steel is inherently resistant to corrosion in the air-indoor environment. Therefore, the aging effect of concern is loss of preload, which is addressed in the AMR.

The staff's evaluation of the applicant's Inspection of the Bolting Integrity Program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage aging using the Bolting Integrity Program acceptable because the Bolting Integrity Program conducts bolting assembly and maintenance control such as application of appropriate gasket alignment, torque, lubricants, and preload. The program also inspects for leakage and loose or missing nuts to verify that the aging effect, loss of preload, will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Steam and Power Conversion Systems—Condensate Storage System—Aging Management Review Results—LRA Table 3.4.2-2

In LRA Table 3.4.2-2, the applicant stated that the steel tanks exposed to moist air are being managed for loss of material by the One-Time Inspection Program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. Based on its review of the GALL Report, which states that steel exposed to moist air is susceptible to loss of material, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's One-Time Inspection Program is documented in SER Section 3.0.3.1.11. The GALL Report recommends that the loss of material aging effect for steel components exposed to moist air be managed by GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." However, in LRA Table 3.4.2-2, the applicant instead proposed to use its One-Time Inspection Program. By letter dated May 2, 2011, the staff issued RAI 3.2.2.1.26-1 requesting that the applicant justify its use of the One-Time Inspection Program for managing these aging effects.

In its response dated June 3, 2011, the applicant did not modify this item because the applicant stated that the One-Time Inspection Program is still credited to confirm the absence of aging effects at the air-water interface when an appropriate program is being used to manage the surface below the air-water interface and a periodic program is being used to manage the surface above the air-water interface. The staff reviewed the LRA and noted that the surface above the air-water interface is being managed by the External Surfaces Monitoring Program, and the surface below the air-water interface is being managed by the PWR Water Chemistry and One-Time Inspection Programs.

In an additional applicant response, dated September 16, 2011, concerning air-water and above-air interface aging management, the applicant revised this item as part of an extent of condition review. The applicant revised the LRA to define that the moist air (internal) environment encompasses both the air-water interface and the air environment above the interface and that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting

Program will manage loss of material (except for selective leaching) and cracking for all in-scope components subject to a moist air environment, including this item.

The staff finds the applicant's response and its proposal to manage aging at and above the air-water interface using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program acceptable because it is consistent with the recommendations in Revision 2 of the GALL Report for managing aging of steel components exposed to moist air. The staff's concern described in RAI 3.2.2.1.26-1 is resolved.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 Steam and Power Conversion Systems—Main Feedwater System—Aging Management Review Results—LRA Table 3.4.2-3

In LRA Table 3.4.2-3, the applicant stated that aluminum filter housings exposed internally to lubricating oil are being managed for loss of material by the Lubricating Oil Analysis and One-Time Inspection Programs. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that while this combination was not addressed in Revision 1 of the GALL Report, the combination is addressed in Revision 2 of the GALL Report. Revision 2 of the GALL Report recommends that aluminum piping, piping elements, and piping components exposed to lubricating oil be managed for loss of material by GALL Report AMP XI.M39, "Lubricating Oil Analysis," and GALL Report AMP XI.M32, "One-Time Inspection." Based on its review of the GALL Report, Revision 2, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Lubricating Oil Analysis and One-Time Inspection Programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.11. The staff finds the applicant's proposal to manage aging using the Lubricating Oil Analysis and One-Time Inspection Programs acceptable because the Lubricating Oil Analysis Program will monitor and control the presence of contaminants in the lubricating oil to preserve an environment that is not conducive to aging, the One-Time Inspection will verify that aging is not occurring, and it is consistent with the methodology for managing loss of material for this component, material, and environment combination in Revision 2 of the GALL Report.

In LRA Table 3.4.2-3, the applicant stated that for the external surfaces of steel piping and valve bodies exposed to air-indoor uncontrolled, there is no aging effect, and no AMP is proposed. The AMR items cite generic note I. The AMR items also cite plant-specific note 0408, which states the following:

> Except for the motor-driven feedwater pump (MDFP) and startup feed pump (SUFP) portions of the Main Feedwater System, the control air supply components associated with the main and start-up control valves, and bolting exposed to 'air with steam or water leakage', loss of material due to general corrosion is not an aging effect requiring management for the external surfaces

of steel components in the Main Feedwater System that are exposed to the air-indoor uncontrolled because the surface temperature is greater than 212 °F and, therefore, the surface is expected to be dry.

The GALL Report describes condensation as an environment where there is enough moisture for corrosion to occur and recommends GALL Report AMP XI.M36, “External Surfaces Monitoring,” to manage loss of material for steel components exposed to condensation through periodic visual inspections of the external surfaces of the in-scope components. The staff noted the applicant’s facility has experienced two extended outages in recent years. Given the plant-specific operating experience, it is not clear to the staff how the specified components addressed in plant-specific note 0408 will be maintained at temperatures greater than 212 °F (100 °C) throughout their service life during the period of extended operation and why they are not considered susceptible to loss of material due to general corrosion from condensation on the surfaces of the specified components. By letter dated May 2, 2011, the staff issued RAI 3.4.2.3-1 requesting that the applicant justify its position that the control air supply components associated with the main and start-up control valves and bolting will not be exposed to temperatures below 212 °F (100 °C) during the period of extended operation; therefore, they have no AERMs.

In its response dated June 3, 2011, the applicant stated that the steel components in the MFW system that are exposed to air-indoor uncontrolled may be exposed to temperatures below 212 °F (100 °C). The applicant also stated that the External Surfaces Monitoring Program will be used to manage those components. The staff finds the applicant’s response, and its proposal to use of the External Surfaces Monitoring Program to manage loss of material, acceptable because the program includes visual inspections that are capable of detecting loss of material, and it is consistent with the recommendations in the GALL Report for steel components exposed to condensation. The staff’s concern described in RAI 3.4.2.3-1 is resolved.

In LRA Tables 3.4.2-3 and 3.4.2-4, the applicant stated that copper alloy with greater than 15 percent Zn heat exchanger tubes exposed to treated water (both external and internal) are being managed for cracking by the PWR Water Chemistry Program and the One-Time Inspection Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, item VIII.A-5, which addresses copper-Zn alloy components exposed to treated water and recommends GALL Report AMP XI.M2, “Water Chemistry,” and XI.M32, “One-Time Inspection,” to manage loss of material due to pitting and crevice corrosion. The staff also noted that the applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in other AMR items in LRA Tables 3.4.2-3 and 3.4.2-4.

The staff’s evaluations of the applicant’s PWR Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.15 and 3.0.3.2.11, respectively. The staff noted that the applicant’s PWR Water Chemistry Program mitigates the occurrence of loss of material by managing the concentration of containments below the levels known to cause loss of material through adherence to the EPRI guidance documents. The staff also noted that the applicant’s One-Time Inspection Program will visually or physically examine a representative sample of components at locations susceptible to concentration of contaminants. Inspection findings that do not meet the acceptance criteria will be tracked through the applicant’s Corrective Action Program. The staff finds the applicant’s proposal to manage aging using the PWR Water Chemistry and the One-Time Inspection Programs acceptable because contaminants that are known to cause loss of material and cracking will be maintained within the EPRI limits, and inspection will verify the efficacy of the PWR Water Chemistry Program.

In LRA Tables 3.4.2-3 and 3.4.2-4, the applicant stated that for aluminum filter housings and valve bodies exposed to dried air (internal), there is no aging effect, and no AMP is proposed. The AMR items cite generic note G. Items associated with aluminum filter housings and valve bodies in Tables 3.4.2-3 and 3.4.2-4 cite plant-specific note 0406, which states that there are no AERMs because the applicant's Air Quality Monitoring Program will ensure that the control air environment supplied from the instrument air system remains dry and free of containments.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that, even though aluminum exposed to dried air is not specifically addressed, the GALL Report, item V.F-2, states that aluminum piping, components, and elements exposed to indoor air uncontrolled (internal/external) have no aging effects or aging mechanisms. No AMP is recommended by the GALL Report. The staff considers dried air to be comparable to the indoor air uncontrolled environment since moisture would not be available to cause degradation, such as loss of material due to pitting.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.4 Steam and Power Conversion Systems—Main Steam System—Aging Management Review Results—LRA Table 3.4.2-4

The staff's evaluation for stainless steel bolting exposed to air with steam or water leakage (external), which is being managed for loss of material and cracking by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.4.2.3.1.

The staff's evaluation for stainless steel bolting exposed to air-indoor uncontrolled (external), which is being managed for loss of preload by the Bolting Integrity Program citing generic note F, is documented in SER Section 3.4.2.3.1.

The staff's evaluation for aluminum valve bodies and filter bodies exposed to dried air (internal), which cite generic note G, is documented in Section 3.4.2.3.3.

The staff's evaluation for copper alloy with greater than 15 percent Zn heat exchanger tubes exposed to treated water (both external and internal), which cite generic note H, is documented in Section 3.4.2.3.3.

In LRA Table 3.4.2-4, as amended by letter dated April 15, 2011, the applicant stated that polymeric anti-siphon devices exposed externally to uncontrolled indoor air are being managed for hardening and loss of strength by the External Surfaces Monitoring Program. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that polymers can either be rigid, like PVC, or flexible, like elastomers. The GALL Report states that PVC exposed to indoor air has no aging effects requiring management and that elastomers exposed to indoor air can experience hardening and loss of strength. The staff also noted that anti-syphon devices are typically constructed of rigid polymers, similar to PVC, and that rigid polymers are resistant to aging effects when exposed to indoor air. Based on its review of the GALL Report, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring Program acceptable because, while no aging of the anti-syphon device is expected, the periodic visual inspections in the External Surfaces Monitoring Program are capable of identifying hardening and loss of strength, as well as loss of material, cracking, and discoloration and, therefore, are capable of detecting any degradation prior to loss of intended function.

In LRA Table 3.4.2-4, the applicant stated that for the polymer SG wet layup chemical addition metering pump casing and anti-siphon device exposed to air with borated water external environment and treated water internal environment, there is no aging effect, and no AMP is proposed. The AMR items cite generic note F.

The staff reviewed the associated items in the LRA and confirmed that no credible aging effects are applicable for this component, material, and environmental combination based on its review of the Engineering Materials Handbook—Engineering Plastics, ASM International, Copyright 1988, which states rigid polymers are 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, but rather than depend on an oxide layer for protection, they depend on chemical resistance to the environments to which they are exposed. The staff further noted that thermoplastic materials are impervious and, once selected for the environment, will not have any significant age-related degradation. Therefore, the staff finds the applicant's determination acceptable.

In LRA Table 3.4.2-4, the applicant stated that the polymer SG wet layup chemical addition metering pump casing and anti-siphon device exposed to an air-indoor uncontrolled external environment is being managed for hardening and loss of strength by the External Surface Monitoring Program. The AMR item cited generic note F.

The staff noted that the term hardening and loss of strength is associated with elastomeric materials in the GALL Report. The staff also noted that hardening in a rigid polymeric pump casing for a SG wet layup chemical addition metering pump would not be applicable.

The staff's evaluation of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3.2.5. The staff noted that the External Surfaces Monitoring Program uses periodic visual inspections and surveillance activities to monitor for material degradation and, as amended by letter dated May 24, 2011, is supplemented by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program. The staff finds the applicant's proposal to manage aging using the External Surface Monitoring Program acceptable because, as stated in the staff's analysis for the same component in an AMR item where the environment is exposure to air with borated water external environment (see above), rigid polymers are unaffected by water, concentrated alkalis, non-oxidizing acids, oils, ozone, sunlight, or humidity changes. Additionally, the inspections proposed by the applicant are capable of detecting change in material properties.

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 addressed in the GALL Report. The staff finds 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).

3.4.3 Conclusion

The staff concludes that the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of Structures and Structural Components

This section of the SER documents the staff's review of the applicant's AMR results for the structures and component supports groups of the following SCs:

- containment (including containment vessel, shield building, and containment internal structures)
- auxiliary building
- intake structure, forebay, and service water discharge structure
- BWST level transmitter building
- Miscellaneous DG building
- office building (CSTs)
- personnel shop facility passageway (missile shield area)
- service water pipe tunnel and valve rooms
- SBODG building (including transformer X-3051 and reactor skid foundations)
- turbine building
- water treatment building
- yard structures
- bulk commodities

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for the containment, structures, and component supports groups. 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 for the structures and component supports groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant 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 remain 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 AMR items that the applicant identified as being consistent with the GALL Report to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.5.2.1.

The staff also conducted a review of selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.5.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.5.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.5.2.3.

For SSCs that the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR items and the plant's operating experience to verify the applicant's claims.

Table 3.5-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.5 and addressed in the GALL Report.

Table 3.5-1. Staff evaluation for structures and component supports components in the GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
PWR Concrete (Reinforced and Prestressed) and Steel Containments BWR Concrete and Steel (Mark I, II, and III) Containments					
Concrete elements—walls, dome, basemat, ring girder, buttresses,	Aging of accessible and inaccessible concrete areas due to	ISI (IWL) and, for inaccessible concrete, an examination of representative samples of	Yes, plant-specific, if environment aggressive	Structures Monitoring Program (B.2.39)	Not applicable to Davis-Besse (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
containment (as applicable) (3.5.1-1)	aggressive chemical attack and corrosion of embedded steel	below-grade concrete and periodic monitoring of groundwater if environment is nonaggressive. A plant-specific program is to be evaluated if environment is aggressive.			
Concrete elements—All (3.5.1-2)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program If a dewatering system is relied upon for control of settlement, then the applicant is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's Structures Monitoring Program or a de-watering system is relied upon	Structures Monitoring Program (B2.39)	Not applicable to Davis-Besse (See SER Section 3.5.2.2.1)
Concrete elements—foundation, subfoundation (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 applicant is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's Structures Monitoring Program or a de-watering system is relied upon	Not applicable	Not applicable to Davis-Besse (See SER Section 3.5.2.2.1)
Concrete elements—dome, wall, basemat, ring girder, buttresses, containment,	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific AMP is to be evaluated.	Yes, plant-specific if temperature limits are exceeded.	Not applicable	Not applicable to Davis-Besse (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 fill-in annulus (as applicable) (3.5.1-4)					
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, if corrosion is significant for inaccessible areas	Not applicable	Not applicable—BWR only (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, if corrosion is significant for inaccessible areas	ISI (IWE) (B.2.22), and 10 CFR Part 50, Appendix J (B.2.1)	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	Not applicable	Not applicable (See SER Section 3.5.2.2.1.5)
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 10CFR 54.21(c)	Yes, TLAA	Not applicable	Not applicable—BWR only (See SER Section 3.5.2.1.1)
Steel, stainless steel	Cumulative fatigue	TLAA, evaluated in accordance	Yes, TLAA	TLAA, evaluated in accordance	Consistent with GALL Report, this item is a

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
elements, dissimilar metal welds—penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-9)	damage (CLB fatigue analysis exists)	with 10 CFR 54.21(c)		with 10 CFR 54.21(c)	TLAA. (See SER Section 3.5.2.2.1.6)
Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds (3.5.1-10)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J and additional appropriate examinations and evaluations for bellows assemblies and dissimilar metal welds	Yes, detection of aging is to be evaluated.	Not applicable	Not applicable (See SER Section 3.5.2.2.1.7)
Stainless steel vent line bellows (3.5.1-11)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J and additional appropriate examinations and evaluations for bellows assemblies and dissimilar metal welds	Yes, detection of aging is to be evaluated.	Not applicable	Not applicable—BWR only (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 supplemented to detect fine cracks	Yes, detection of aging is to be evaluated.	Not applicable	Not applicable (See SER Section 3.5.2.2.1.8)
Steel, stainless steel elements, dissimilar metal welds—torus; vent	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J supplemented to detect fine cracks	Yes, detection of aging is to be evaluated.	Not applicable	Not applicable—BWR only (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
line; vent header; vent line bellows; downcomers (3.5.1-13)					
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, for inaccessible areas of plants located in moderate to severe weathering conditions.	Not applicable	Not applicable (See SER Section 3.5.2.2.1.9)
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, if concrete was not constructed as stated in inaccessible areas.	Not applicable	Not applicable (See SER Section 3.5.2.2.1.10)
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) (B.2.22) and 10 CFR Part 50, Appendix J (B.2.1) Programs	Consistent with GALL Report
Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and Plant TS	No	ISI Program—IWE (B.2.22), the 10 CFR Part 50, Appendix J Program (B.2.1), and Plant TS surveillance testing requirements	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
(3.5.1-17)					
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	ISI (IWE) (B.2.22), and 10 CFR Part 50, Appendix J (B.2.1) Programs	Consistent with GALL Report
Steel elements—stainless steel suppression chamber shell (inner surface) (3.5.1-19)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable—BWR only (See SER Section 3.5.2.1.1)
Steel elements—suppression chamber liner (Inner 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—BWR only (See SER Section 3.5.2.1.1)
Steel elements—drywell head and downcomer pipes (3.5.1-21)	Fretting or lock up due to mechanical wear	ISI (IWE)	No	Not applicable	Not applicable—BWR only (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	Not applicable	Not applicable (See SER Section 3.5.2.1.1)
Safety-related and other structures and component supports					
All Groups except Group 6—interior and above-grade exterior concrete (3.5.1-23)	Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes, if not within scope of the applicant's Structures Monitoring Program.	Structures Monitoring Program (B.2.39)	Consistent with GALL Report (See SER Section 3.5.2.2.2.1.1)
All Groups except	Increase in porosity and	Structures Monitoring	Yes, if not within scope of the	Structures Monitoring	Consistent with GALL Report (See SER

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—interior and above-grade exterior concrete (3.5.1-24)	permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Program	applicant's Structures Monitoring Program.	Program (B.2.39)	Section 3.5.2.2.2.1.2)
All Groups except Group 6—steel components—all structural steel (3.5.1-25)	Loss of material due to corrosion	Structures Monitoring Program If protective coatings are relied upon to manage the effects of aging. the Structures Monitoring Program is to include provisions to address protective coating monitoring and maintenance.	Yes, if not within the scope of the applicant's Structures Monitoring Program.	Structures Monitoring Program (B.2.39)	Consistent with GALL Report (See SER Section 3.5.2.2.2.1.3)
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, if not within the scope of the applicant's Structures Monitoring Program or for inaccessible areas of plants located in moderate to severe weathering conditions.	Structures Monitoring Program (B.2.39)	Consistent with GALL Report (See SER Section 3.5.2.2.2.1.4)
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, if not within the scope of the applicant's Structures Monitoring Program or concrete was not constructed as stated for inaccessible areas.	Structures Monitoring Program (B.2.39)	Not applicable (See SER Section 3.5.2.2.2.1.5)
Groups 1–3 and 5–9—All	Cracks and distortion due to increased	Structures Monitoring Program	Yes, if not within the scope of the applicant's	Structures Monitoring Program	Not applicable (See SER Section 3.5.2.2.2.1.6)

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
(3.5.1-28)	stress levels from settlement	If a de-watering system is relied upon for control of settlement, then the applicant is to ensure proper functioning of the de-watering system through the period of extended operation.	Structures Monitoring Program or a de-watering system is relied upon.	(B.2.39)	
Groups 1–3 and 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 applicant is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's Structures Monitoring Program.	Not applicable	Not applicable (See SER Section 3.5.2.2.2.1.7)
Group 4—Radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; SG supports (3.5.1-30)	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes, if not within the scope of the ISI or structures monitoring.	ISI Program—IWF (B.2.23) and Structures Monitoring Program (B.2.39)	Not applicable (See SER Section 3.5.2.2.2.1.8)
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,	Structures Monitoring Program Examination of representative samples of below-grade concrete and periodic monitoring of groundwater, if the environment is non-aggressive. A	Yes, plant-specific, If environment is aggressive.	Structures Monitoring Program (B.2.39)	Consistent with GALL Report (See SER Section 3.5.2.2.2.2.4).

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
	scaling), corrosion of embedded steel	plant-specific program is to be evaluated if environment is aggressive.			
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, if concrete was not constructed as stated for inaccessible areas.	Structures Monitoring Program (B.2.39) for accessible areas	Consistent with GALL Report (See SER Section 3.5.2.2.2.2.5)
Groups 1–5 Concrete (3.5.1-33)	Reduction of strength and modulus due to elevated temperature	Plant-specific	Yes, plant-specific if temperature limits are exceeded.	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2.3)
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/USACE 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. Plant-specific if environment is aggressive.	Water-Control Structures Inspection (B.2.40)	Consistent with GALL Report (See SER Section 3.5.2.2.2.4.1)
Group 6—Exterior above- and below-grade concrete foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs.	Yes, for inaccessible areas of plants located in moderate to severe weathering	Water Control Structures Inspection Program (B.2.40)	Consistent with GALL Report (See SER Section 3.5.2.2.2.4.2)

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
(3.5.1-35)		Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr). (NUREG-1557)	conditions.		
Group 6—All accessible and inaccessible reinforced concrete (3.5.1-36)	Cracking due to expansion/re-action with aggregates	Accessible areas—Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas.	Water Control Structures Inspection (B.2.40)	Not applicable (See SER Section 3.5.2.2.2.4.3)
Group 6—Exterior above- and below-grade reinforced concrete foundation interior slab (3.5.1-37)	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas.	Water Control Structures Inspection Program (B.2.40)	Consistent with GALL Report (See SER Section 3.5.2.2.2.4.3)
Groups 7 & 8—Tank liners (3.5.1-38)	Cracking due to SCC; loss of material due to pitting and crevice corrosion	Plant-specific	Yes	Not applicable	Not applicable (See SER Section 3.5.2.2.2.5)
Support members, welds; bolted connections; support	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring	Structures Monitoring Program (B.2.39)	Consistent with GALL Report (See SER Section 3.5.2.2.2.6.1)

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
anchorage to building structure (3.5.1-39)			Program.		
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, if not within the scope of the applicant's Structures Monitoring Program.	Structures Monitoring Program (B.2.39)	Not applicable (See SER Section 3.5.2.2.2.6.2)
Vibration isolation elements (3.5.1-41)	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring Program.	Structures Monitoring Program (B.2.39)	Not applicable (See SER Section 3.5.2.2.2.6.3)
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, TLAA	Not applicable	Not applicable (See SER Section 3.5.2.2.2.7).
Groups 1–3, 5, 6—All masonry block walls (3.5.1-43)	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Masonry Wall Inspection Program (B.2.27), Structures Monitoring Program (B.2.39), and Fire Protection Program (B.2.17)	Consistent with GALL Report
Group 6—Elastomer seals, gaskets, and moisture barriers	Loss of sealing due to deterioration of seals, gaskets, and moisture	Structures Monitoring Program	No	Structures Monitoring Program (B.2.39) and Fire Protection 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
(3.5.1-44)	barriers (caulking, flashing, and other sealants)			(B.2.17)	
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/USACE dam inspections and maintenance	No	Water-Control Structures Inspection Program (B.2.40)	Not applicable (See SER Section 3.5.2.1.1)
Group 5—Fuel pool Liners (3.5.1-46)	Cracking due to SCC and loss of material due to pitting and crevice corrosion	Water chemistry and monitoring of SFP water level and level of fluid in the leak chase channel	No	PWR Water Chemistry Program (B.2.33) and Leak Chase Monitoring Program (B.2.25)	Consistent with GALL Report
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 Associated with Nuclear Power Plants If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	Water-Control Structures Inspection Program (B.2.40)	Consistent with GALL Report
Group 6—Earthen water control structures—Dams, embankments, reservoirs, channels, canals, and ponds (3.5.1-48)	Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, and seepage	Inspection of water-control structures associated with nuclear power plants	No	Water-Control Structures Inspection Program (B.2.40)	Consistent with GALL Report
Support members—Welds; bolted connections; support	Loss of material due to general, pitting, and crevice	Water chemistry and ISI (IWF)	No	Structures Monitoring Program (B.2.39) and PWR Water	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
anchorage to building structures (3.5.1-49)	corrosion			Chemistry Program (B.2.33)	
Groups B2 and B4—Galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-50)	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Structures Monitoring Program (B.2.39)	Consistent with GALL Report
Group B1.1—High strength low-alloy bolts (3.5.1-51)	Cracking due to SCC and loss of material due to general corrosion	Bolting Integrity Program (XI.M18)	No	Bolting Integrity Program (B.2.4)	Consistent with GALL Report
Groups B2 and B4—Sliding support bearings and sliding support surfaces (3.5.1-52)	Loss of mechanical function due to corrosion, distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	Not applicable	Not applicable (See SER Section 3.5.2.1.1)
Groups B1.1, B1.2, and B1.3—Support members—Welds; bolted connections; support anchorage to building structure (3.5.1-53)	Loss of material due to general and pitting corrosion	ISI (IWF)	No	ASME Code Section XI, Subsection IWF Program (B.2.23)	Consistent with GALL Report
Groups B1.1, B1.2, and B1.3—Constant and variable load spring	Loss of mechanical function due to corrosion, distortion, dirt, overload, and	ISI (IWF)	No	ASME Code Section XI, Subsection IWF Program (B.2.23)	Not applicable (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
hangers; guides; stops (3.5.1-54)	fatigue due to vibratory and cyclic thermal loads				
Steel, galvanized steel, and aluminum support members; welds; bolted connections; support anchorage to building structure (3.5.1-55)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program (B.2.6)	Consistent with GALL Report
Groups B1.1, B1.2, and B1.3—Sliding surfaces (3.5.1-56)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	ASME Code Section XI, Subsection IWF Program (B.2.23)	Consistent with GALL Report
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
Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air-indoor uncontrolled	None	None	Not applicable—No AERM or AMP	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
(3.5.1-58)					
Stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-59)	None	None	No	None	Consistent with GALL Report

The staff's review of the structures and component supports groups followed any one of several approaches. One approach, documented in SER Section 3.5.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.5.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the structures and component supports component groups is documented in SER Section 3.0.3.

As a result of Revision 2 to the SRP-LR and the GALL Report, there was a significant realignment of AMR items as follows:

- In some cases, changes were of an administrative nature (e.g., an identical material, environment, aging effect, and recommended program in Table 3.5-1of the SRP-LR was renumbered with no other changes).
- Technical changes were implemented for specific Table 3.5-1 items (e.g., component information clarified, changes to environment, added concrete attributes evaluation, clarified BWR and PWR applicability).
- Many SRP-LR further evaluation recommendations were eliminated, principally because Revision 2 implemented changes to GALL Report AMPs and AMR items resulting in the further evaluation being addressed. As an example, Revision 1 of the SRP-LR and GALL Report recommended a further evaluation of a plant-specific program to manage hardening and loss of strength of elastomeric components exposed to air-indoor uncontrolled. Revision 2 of the SRP-LR and GALL Report incorporated elastomeric components, including visual exams and manipulation of the material into GALL Report AMPs XI.M36, "External Surfaces Monitoring of Mechanical Components" and XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," thus eliminating the need for a plant-specific program.
- Revision 2 contains additional material, environment and aging effect combinations, thus eliminating the need for citing generic notes F–J given that the applicant could now select a Table 3.5-1 that is consistent. For example, AMR item 3.4-53, which addresses copper alloy (less than or equal to15 percent Zn and less than or equal to 8 percent Al)

piping, piping components, and piping elements exposed to air with borated water leakage, was added.

In each instance, regardless of the type of change, the staff evaluated the Revision 1 technical requirements compared to the Revision 2 technical requirements and ensured that the applicant's LRA was evaluated against the current staff position as contained in Revision 2.

3.5.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.5.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the structures and structural components and their commodity groups:

- 10 CFR Part 50, Appendix J Program (B.2.1)
- ASME Section XI, Subsection IWE Program (B.2.22)
- ASME Section XI, Subsection IWF Program (B.2.23)
- Bolting Integrity Program (B.2.4)
- Boral® Monitoring Program (B.2.5)
- Boric Acid Corrosion Program (B.2.6)
- Cranes and Hoists Inspection Program (B.2.10)
- Fire Protection Program (B.2.17)
- Leak Chase Monitoring Program (B.2.25)
- Masonry Wall Inspection Program (B.2.27)
- PWR Water Chemistry Program (B.2.33)
- Structures Monitoring Program (B.2.39)
- Water Control Structures Inspection Program (B.2.40)

Although not identified directly in LRA Section 3.5.2.1, LRA Table 3.5.1 identifies the TLAA Program under the discussion column that manages aging effects for the structures and structural components and their commodity groups for specified conditions.

LRA Tables 3.5.2-1 through 3.5.2-13 summarize AMRs for the structures and component supports component groups and indicate AMRs claimed to be consistent with the GALL Report.

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

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

Note A indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff reviewed these items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff reviewed these items to verify consistency with the GALL Report and confirmed that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

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

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

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

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did 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 did the following:

- provided a brief description of the system, components, materials, and environments
- stated that the applicable aging effects were reviewed and evaluated in the GALL Report
- identified those aging effects for the structures and structural components and their commodity groups that are subject to an AMR

On the basis of its audit and review, the staff determined that, for AMRs not requiring further evaluation, as identified in LRA Table 3.5.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant identified were consistent with the AMRs of the GALL Report and for which the staff determined were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follow.

3.5.2.1.1 AMR Results Identified as Not Applicable

In Table 3.5.1, for items 3.5.1-5, 3.5.1-8, 3.5.1-11, 3.5.1-13, 3.5.1-19, 3.5.1-20, 3.5.1-21, and 3.5.1-22, the applicant states that the corresponding AMR items in the GALL Report are not applicable for the following reasons:

- Davis-Besse is a PWR reactor design that incorporates a steel containment structure that is enclosed by a reinforced concrete shield building.
- The AMR items in the GALL Report are only applicable to particular components of BWR designs.
- The AMR items in the GALL Report are only applicable to BWR or PWR designs that use a reinforced concrete or post-tensioned concrete containment.

The staff confirmed that the stated AMR items in the GALL Report are only applicable to BWR designs, and BWR or PWR designs that use a reinforced concrete or post-tensioned concrete containment and are not applicable to the Davis-Besse LRA.

For items 3.5.1-41, 3.5.1-52, and 3.5.1-57, the applicant claimed that they were not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at Davis-Besse. The staff reviewed the LRA and USAR and confirmed that the applicant's LRA does not have any AMR results that are applicable to these items.

For LRA Table 3.5.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable; however, the staff non-applicability verification of these items required the review of sources beyond the LRA and FSAR, and/or the issuance of RAIs.

LRA Table 3.5.1, item 3.5.1-45, addresses concrete exposed to flowing water. The GALL Report recommends the Inspection of Water-Control Structures Program to manage loss of material due to abrasion and cavitation for this component group. The applicant stated that this item is not applicable because concrete aging effects are addressed in other AMR items, including 3.5.1-34, 3.5.1-35, and 3.5.1-37. The applicant further stated that the Water Control Structures Inspection AMP is credited for this aging effect even though the AMR did not identify AERMs. The staff evaluated the applicant's claim and found it acceptable because, although the applicant claimed the aging effect was not applicable, it still credited the appropriate GALL Report recommended AMP for aging management.

LRA Table 3.5.1, item 3.5.1-54, addresses supports for ASME Code piping and components exposed to an air-indoor or outdoor environment. The GALL Report recommends the ASME Section XI, Subsection IWF Program to manage loss of mechanical function for this component group. The applicant stated that this item is not applicable because aging of these components was addressed in item 3.5.1-53. The applicant further stated that the inspection criteria in the ISI Program—IWF effectively envelopes loss of mechanical function. The staff reviewed the applicant's IWF Program and confirmed that the inspections to detect loss of mechanical function were included in the program. The staff evaluated the applicant's claim and found it acceptable because appropriate inspections to detect loss of mechanical function were included in the applicant's IWF Program, regardless of the LRA identifying the item as not applicable. The staff's review of the ISI Program—IWF is documented in SER Section 3.0.3.1.11.

The remaining items, identified as not applicable in LRA Table 3.5.1, require further evaluation and are discussed in the corresponding subsections of SER Section 3.5.2.2.

3.5.2.1.2 Change in Material Properties

LRA Tables 3.5.2-1 through 3.5.2-13 show many concrete structures or components listing “change in material properties” as an AERM and listing the Structures Monitoring Program enhanced with ACI 349.3R-96 and ANSI/ASCE 11-90, and the included Water Control Structures Inspection Program, to support the detection of this aging effect. It is not clear to the staff in which material properties the applicant seeks to detect changes. It is also not clear to the staff how the “change in material properties aging effect” will be detected, especially when some of the AMR items are difficult to access or below grade. For structures or structural components, identification of changes in concrete material properties (e.g., compressive, tensile strengths) requires testing. To address these concerns, by letter dated May 2, 2011, the staff issued RAI 3.5.2.1-1 requesting that the applicant identify the material properties of interest and how changes in the properties will be identified.

In its response letter dated June 3, 2011, the applicant explained that the “change in material properties” aging effect in the LRA was appropriate and was intended to encompass all applicable aging effects due to leaching of calcium hydroxide and aggressive chemical attack. The applicant further stated that these aging effects were addressed in GALL Report, items III.A1-5, III.A1-7, III.A3-5, III.A3-7, III.A6-3, and III.A6-6. The applicant stated that these GALL Report items recommend aging management by visual inspections conducted under the Structures Monitoring or Water-Control Structures Inspection Programs, with plant-specific supplemental inspections recommended for applicants with operating experience with aggressive groundwater. The applicant finally stated that their Structures Monitoring Program, enhanced to follow the guidance of ACI 349.3R, would be appropriate to detect the aging effects of concern, and additional inspections to address the aggressive groundwater would be conducted prior to the period of extended operation, as discussed in the response to Structures Monitoring Program RAI B.2.39-3.

The staff’s reviews of the applicant’s Structures Monitoring Program, including RAI B.2.39-3, and the Water-Control Structures Inspection Program are discussed in SER Sections 3.0.3.2.15 and 3.0.3.2.16, respectively. During its review, the staff noted that the applicant’s Structures Monitoring Program, which implements the Water-Control Structures Inspection Program, includes appropriate visual inspections to detect the GALL Report recommended aging effects. The staff also noted that the visual inspections are conducted, per the guidance of ACI 349.3R, on a frequency of 5 years, as recommended in the GALL Report. In addition, the applicant is addressing operating experience with aggressive groundwater infiltration and leaching of calcium hydroxide with focused inspections prior to the period of extended operation, as discussed in the review of RAI B.2.39-3. The staff reviewed the applicant’s response and finds it acceptable because, although the applicant used different wording for the aging effects, the applicant inspects for the appropriate GALL Report recommended aging effects using appropriate visual inspections. Therefore, the staff's concerns described in RAI 3.5.2.1-1 are resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.5.2, 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 and 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 (below-grade inaccessible concrete areas of Groups 1–5 and 7–9 structures)
- reduction of strength and modulus of concrete structures due to elevated temperature for Group 1–5 structures
- aging management of inaccessible areas for Group 6 structures (below-grade inaccessible concrete areas)
- cracking due to SCC and loss of material due to pitting and crevice corrosion for Group 7 and 8 stainless steel tank liners
- 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 claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine if it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.5.2.2. The staff's review of the applicant's further evaluation follows.

3.5.2.2.1 Pressurized-Water Reactor and Boiling-Water Reactor Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which address several areas.

Aging of Inaccessible Concrete Areas. LRA Section 3.5.2.2.1.1, associated with LRA Table 3.5.1, item 3.5.1-1, addresses aging of inaccessible concrete areas that are being managed for aggressive chemical attack and corrosion of embedded steel by the ASME Section XI, Subsection IWL Program. The LRA states that this item is not applicable because the ASME Section XI, Subsection IWL Program does not apply since the primary containment is a free-standing steel pressure vessel enclosed in a shield building that is supported on a reinforced concrete foundation founded on a firm rock structure. The LRA further states the following:

- The below-grade environment is aggressive (i.e., chlorides greater than 500 ppm and sulfates greater than 1,500 ppm, the minimum groundwater pH is 6.9).
- Portions of the containment structures are located below the normal groundwater level.
- Exterior portions of plant structures below the normal groundwater level have been provided with waterproofing, but water leakage, above and below grade, has been observed at the plant.

The LRA also states that the following actions will be taken under the Structures Monitoring Program:

- Raw water chemistry (i.e., pH, chlorides, and sulfates) will be collected at least once every 5 years and include seasonal variations.
- Below-grade inaccessible concrete components will be monitored before and during the period of extended operation.
- An examination of an in-scope structure will be completed prior to the period of extended operation that addresses the concrete below the groundwater elevation.
- When a below-grade concrete structural component becomes accessible through excavation, the exposed concrete surfaces will be examined for age-related degradation.

The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1, which state 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 PWR and BWR concrete and steel containments. The GALL Report identifies ASME Section XI, Subsection IWL to manage these aging effects and recommends further evaluation of plant-specific programs to manage these aging effects for inaccessible areas if the environment is aggressive.

The staff reviewed the USAR and confirmed that no Davis-Besse containment concrete serves a pressure retaining function. Therefore, the concrete is not subject to IWL inspections or further evaluation, and the staff finds the applicant's not applicable claim acceptable. The staff notes that aging of the accessible and below-grade reinforced concrete associated with the containment vessel and the shield building is managed by the Structures Monitoring Program and discussed in SER Section 3.5.2.2.2. The staff's review of the Structures Monitoring Program, which dispositioned the impact of aggressive groundwater on reinforced concrete structures, is documented in SER Section 3.0.3.2.15. In addition, the staff noted that monitoring of aging effects of the shield building concrete is done through visual inspections delineated by 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 3.0.3.1.1.

Cracks and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundations, If Not Covered by the Structures Monitoring Program. LRA Section 3.5.2.2.1.2, associated with LRA Table 3.5.1, items 3.5.1-2 and 3.5.1-3, addresses cracks and distortion of concrete elements due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations. The applicant stated that cracking and distortion due to settlement are not AERMs for containment concrete components because, based on settlement analyses, it is estimated that maximum settlements of Class I structures (e.g., containment or shield building) will be less than $^{1}/_{8}$-inch. Therefore, further evaluation of increased stress levels due to settlement is not required. The applicant further stated that the containment does not have a porous concrete subfoundation; therefore, further evaluation for aging effects due to erosion of porous concrete is not required.

The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2, which state that cracks and distortion due to increased stress levels from settlement and reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur. The GALL Report identifies the Structures Monitoring Program to manage these aging effects, and no further evaluation is recommended if this activity is within scope of the Structures Monitoring Program.

Through a review of the USAR, the staff confirmed that the applicant does not have porous concrete subfoundations or a dewatering system. The staff also noted that structures and structural components are monitored under the applicant's Structures Monitoring Program for aging effects related to settlement, including cracking and distortion. The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15. In its review of components associated with items 3.5.1-2 and 3.5.1-3, the staff finds that further evaluation is not required because all necessary components and aging effects are within the scope of the Structures Monitoring Program, and the containment does not have porous concrete subfoundations. Therefore, the staff finds the applicant's determination acceptable.

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. LRA Section 3.5.2.2.1.3, associated with LRA Table 3.5.1, item 3.5.1-4, addresses reduction of strength and modulus of concrete structures exposed to elevated temperatures. The GALL Report recommends further evaluation for any concrete elements that exceed the specified temperature limits of 150 °F general and 200 °F local for normal operation or any other long-term period. In the LRA, the applicant stated that this item is not applicable because concrete associated with the containment basemat is not exposed to long-term temperatures above these limits. The staff reviewed the USAR and confirmed that no in-scope containment concrete is exposed to temperatures exceeding the GALL Report limits; therefore, it finds the applicant's determination acceptable. The applicant, however, also stated that elevated temperature is an issue of concern in the upper regions of the containment internal structures. Concrete inside containment (containment internal structures) and the concrete foundation of the shield building that supports containment are evaluated in Section 3.5.2.2.2.

Loss of Material Due to General, Pitting, and Crevice Corrosion. LRA Section 3.5.2.2.1.4, associated with LRA Table 3.5.1, item 3.5.1-6, addresses steel elements of accessible and inaccessible areas of containments that are being managed for loss of material due to general, pitting, and crevice corrosion by the ASME Section XI, Subsection IWE and10 CFR Part 50, Appendix J Programs. The LRA stated that loss of material due to corrosion of steel elements of accessible areas is managed by the ISI Program—IWE, the 10 CFR Part 50 Appendix J Program, the Boric Acid Corrosion Program, and the Structures Monitoring Program. The LRA also stated that UT measurements of the containment vessel wall confirmed that the minimum recorded vessel wall thickness (1.404 in.) exceeded the minimum required wall thickness (1.35 in.), and visual examinations of the entire accessible internal surface of the containment vessel are conducted every $3^1/_3$ years as well as visual inspections of the internal moisture barrier at the concrete-to-steel interface during every RFO. The LRA further stated that concrete SCs at Davis-Besse were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66 using ingredients conforming to ACI and ASTM Standards.

The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4, which state that loss of material due to general, pitting, and crevice corrosion could occur in steel elements of accessible and inaccessible areas for containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J Programs to manage this aging effect. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant. GALL Report, item II.A2-9, states that for inaccessible areas (embedded steel shell or liner) loss of material due to corrosion is not significant if the following conditions are satisfied:

- Concrete meeting the specifications of ACI 318 or 349 and the guidance of ACI 201.2R was used for the containment concrete in contact with the embedded containment shell or liner.
- The concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.
- The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with ASME Section XI, Subsection IWE requirements.
- Borated water spills and water ponding on the containment concrete floor is not common and, when detected, is cleaned up in a timely manner.

The staff's reviews of the applicant's ISI Program—IWE, the 10 CFR Part 50 Appendix J Program, the Boric Acid Corrosion Program, and the Structures Monitoring Program are documented in SER Sections 3.0.3.1.10, 3.0.3.1.1, 3.0.3.1.2, and 3.0.3.2.15, respectively. Following an assessment of the program reviews above and the USAR, the staff noted that this is a free-standing containment vessel surrounded by a reinforced concrete shield building. The staff also noted that ACI 318 and ACI 301 incorporate recommendations of ACI 201.2R-77, "Guide for Durable Concrete." The staff further noted the following:

- The concrete was monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.

- The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with ASME Section XI, Subsection IWE requirements.
- Borated water spills and water ponding on the containment concrete floor is not common and, when detected, is cleaned up in a timely manner.
- The concrete met ACI specifications.

In its review of components associated with item 3.5.1-6, the staff finds that the applicant met the further evaluation criteria. Additionally, the applicant's proposal to manage aging using the ISI Program—IWE and the 10 CFR Part 50, Appendix J Program is acceptable because the applicant's approach is consistent with the recommendations in GALL Report, item II.A2-9, and the conditions are satisfied to demonstrate that corrosion in inaccessible areas is not significant.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.4 criteria. For those AMR items that apply to LRA Section 3.5.2.2.1.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. LRA Section 3.5.2.2.1.5, associated with LRA Table 3.5.1, item 3.5.1-7, addresses loss of prestress due to relaxation, shrinkage, creep, and elevated temperature in prestressed containment tendons. In the LRA, the applicant stated that this item is not applicable because the containment structure does not use a prestressed concrete containment design so there are no prestressing tendons. The staff finds the applicant's determination acceptable on the basis that the containment is a free-standing steel containment with no prestressing tendons.

Cumulative Fatigue Damage. LRA Section 3.5.2.2.1.6, associated with LRA Table 3.5.1, item 3.5.1-9, addresses steel, stainless steel elements, dissimilar metal welds; penetration sleeves, penetration bellows; suppression pool shell; and unbraced downcomers. It states that TLAAs are evaluated in accordance with 10 CFR 54.21(c) and that the evaluation of this TLAA is addressed in Section 4.6. In its review of components associated with item 3.5.1-09, the applicant cited generic note C and plant-specific notes 513 and 514. Plant-specific note 513 states that the containment vessel satisfies Section N415-1 of the ASME Code, which does not require analysis for cyclic operations and, as noted in LRA Section 4.6.1, remains valid through the period of extended operation. Plant-specific note 514 states that the effects of fatigue on the intended functions of the permanent reactor cavity seal plate seal membrane will be managed for the period of extended operation by the applicant's proposed Fatigue Monitoring Program.

The staff reviewed the associated items in the LRA and noted that for both the containment vessel and the permanent reactor cavity seal plate (also known as permanent canal seal plate) the applicant referenced GALL Report (Revision 1), item II.A3-4. The staff further noted that this item encompasses the penetration sleeves; penetration bellows made of steel, stainless steel; and dissimilar welds in an air-indoor uncontrolled or air-outdoor environment. The staff also noted that the selected AMR item applies only if there is a CLB fatigue analysis. The staff finally noted that fatigue as a TLAA, in accordance with the SRP-LR Section 4.6, titled "Containment Liner Plate and Penetration Fatigue Analysis," needs to be evaluated for the period of extended operation per 10 CFR 54.21(c)(1).

For AMR items with plant-specific note 514, the staff confirmed that the applicant dispositioned the LRA TLAA Section 4.6.3, “Permanent Canal Seal Plate,” for the fatigue of the structure, component/aging effect combination per 10 CFR 54.21(c)(1)(iii) for the period of extended operation. The staff also confirmed that the Fatigue Monitoring Program monitors the number of occurrences of permanent canal seal plate heatup and cooldown to ensure that actions are taken before the analyzed number of transients are reached. Therefore, the staff finds the applicant’s approach to be consistent with the recommendations of the GALL Report, item II.A3-4. The staff’s reviews of the applicant’s permanent canal seal plate TLAA and the Fatigue Monitoring Program are documented in SER Sections 4.6.3 and 3.0.3.2.6, respectively.

For AMR items with plant-specific note 513, however, the staff noted a discrepancy between the GALL Report and the LRA. Item II.A3-4 references the SRP-LR Section 4.6, “Containment Liner Plate and Penetration Fatigue Analysis,” and discusses acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1). The LRA, as noted previously, excludes the containment vessel from TLAA, on the basis of a lack of CLB fatigue analysis. The staff reviewed the applicant’s USAR Section 3.8.2.1.5 and confirmed that the containment vessel, per paragraph N-415.1, Section III of the ASME Code, was not subject to analysis for cyclic operation. To resolve this discrepancy, however, the staff issued RAI 3.5.2.3.1-1 by letter dated May 2, 2011, asking the applicant to explain the selection of item II.A3-4 and resolve the apparent contradiction.

By letter dated June 3, 2011, the applicant responded, reiterating that there is no CLB fatigue analysis assessing damage incurred from cyclic loading of penetration sleeves and bellows referenced in Table 3.5.1-9 and LRA Section 4.6.2. The applicant further stated that item II.A3-4, within GALL Report, Sections II.A2 or II.A3, is the only item that provides a pointer to the LRA TLAA section as the recommended AMP. The listing of GALL Report, item II.A3-4, included in LRA Table 3.5.2-1, references the containment vessel and the permanent reactor cavity seal plate, which are not the same component identified by GALL Report, item II.A3-4. The two LRA items have been evaluated as TLAAs and dispositioned in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(iii), respectively. Generic note C indicated that the components are different from, but consistent with, the GALL Report item for material, environment, and aging effect and that the AMP is consistent with the recommended GALL Report AMP evaluation of fatigue as a TLAA. Therefore, the applicant concluded that the usage of NUREG-1801, item II.A3-4, with a generic note C is not a contradiction of the AMR of containment vessel penetrations being excluded from fatigue analysis.

The staff confirmed that the selected item II.A3-4, in the GALL Report, is the only available pointer for the appropriate LRA section(s) for appropriate TLAA dispositions. The staff’s concerns raised in RAI 3.5.2.3.1-1 are resolved. The staff notes that the subsection is consistent with SRP-LR Section 3.5.2.2.1.6 and, therefore, is acceptable.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking Due to Stress Corrosion Cracking. LRA Section 3.5.2.2.1.7, associated with LRA Table 3.5.1, item 3.5.1-10, addresses cracking due to SCC in stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds. The applicant stated that this item is not applicable because both temperature greater than 140 °F and an aggressive environment, which are needed for SCC to initiate, are not simultaneously present for any of the components. The staff noted that LRA Section 3.5.2.2.1.10 states that the change in material properties due to leaching of calcium hydroxide is an AERM for concrete components because water leakage (above and below grade) has been observed at the site. Further clarification is needed by the staff to determine whether or not the applicant's AMR adequately evaluated this operating experience in its determination that cracking due to SCC is not an applicable aging effect for the stainless containment penetration components.

By letter dated May 2, 2011, the staff issued RAI 3.5.2.2.1.7-1, asking the applicant to justify why the water leakage addressed in LRA Section 3.5.2.2.1.10 is not conducive to SCC of the stainless steel penetration sleeves and bellows. In addition, the applicant was asked to clarify whether or not the water leakage has been in contact with the containment penetration components and to describe the operating experience in terms of the occurrence of SCC in these components. In addition, if SCC has been observed in these components, the staff asked the applicant to justify why this aging effect is not applicable to the containment penetration components.

In its response dated June 3, 2011, the applicant stated that the two water leakage events (above and below grades), addressed as operating experience in LRA Section 3.5.2.2.1.10, were determined not to be conducive to SCC for stainless steel penetration sleeves and bellows. The above-grade leakage is due to refueling cavity leakage inside the containment during refueling, and the leakage is not in the vicinity of and cannot leak onto any containment penetration sleeves or bellows. The below-grade leakage is due to a reoccurring issue of groundwater intrusion into the annulus between the containment and the shield building, and a 2002 condition report identified that the two stainless steel bellows and flanges for the containment emergency sump recirculation valves had a rusty appearance. The applicant stated that corrective actions directed sampling of the water and repairs to identify and correct the source of leakage. The evaluation of the residue on the bellows identified that it contained calcium, which was a result of groundwater seepage. The applicant stated that cracking due to SCC is not applicable for these bellows because the normal temperature is less than 140 °F (60 °C). A review of plant operating experience performed by the applicant confirmed that no other containment penetration bellows have been affected by groundwater intrusion and that cracking of penetration sleeves or bellows was not identified. While cracking of penetration bellows and sleeves is not considered to be an applicable aging effect, the applicant stated that these components are inspected by the ISI Program—IWE. The staff confirmed, in LRA Section 3.5.2-1, that the applicant performs examinations and tests on the containment penetration components in accordance with the ISI Program—IWE and 10 CFR Part 50, Appendix J Program.

The staff finds the applicant's response acceptable for the following reasons:

- The normal operating temperature of the bellows that have been exposed to the groundwater intrusion is below the threshold temperature in which SCC occurs.
- The applicant confirmed that no other containment penetration bellows have been affected by groundwater intrusion and that its plant-specific operating experience did not reveal any occurrence of cracking in the penetration components.
- These components are examined and tested in accordance with the ISI Program—IWE and 10 CFR Part 50, Appendix J Program, which are adequate to ensure the absence of this aging effect.

The staff's concerns described in RAI 3.5.2.5.1.7-1 were resolved; therefore, the staff finds the applicant's claim acceptable.

Cracking Due to Cyclic Loading. LRA Section 3.5.2.2.1.8, associated with LRA Table 3.5.1, item 3.5.1-12, addresses cracking due to cyclic loading of steel, stainless steel elements, and dissimilar metal welds in penetration sleeves and bellows exposed to an air environment. In the LRA, the applicant stated that item 3.5.1-12 is not applicable. The applicant also stated that the containment vessel shell, piping penetrations of the containment vessel, and the permanent reactor cavity seal plate (i.e., permanent canal seal plate) were addressed in SER Section 3.5.2.2.1.6. The staff confirmed that cracking due to cyclic loading of containment vessel shell, piping penetrations of the containment vessel, and the permanent reactor cavity seal plate are addressed in LRA Sections 4.6.1, 4.6.2, and 4.6.3, respectively, and the staff's review is documented in the corresponding SER sections. The aging of containment piping penetrations without a fatigue analysis was addressed by RAI B.2.22-4, and the discussion of this issue and RAI is addressed in SER Section 3.0.3.1.10, "Inservice Inspection (ISI) Program—IWE."

Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw. LRA Section 3.5.2.2.1.9, associated with LRA Table 3.5.1, item 3.5.1-14, addresses loss of material (scaling, cracking, and spalling) in concrete containment elements due to freeze–thaw. The GALL Report recommends further evaluation of inaccessible areas for plants located in moderate to severe weathering conditions. In the LRA, the applicant stated that this item is not applicable because the containment is a free-standing steel containment enclosed by a concrete shield building. Following a review of the USAR, the staff confirmed that the primary containment is a steel vessel; therefore, the staff finds the applicant's determination acceptable.

Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide. LRA Section 3.5.2.2.1.10, associated with LRA Table 3.5.1, item 3.5.1-15, addresses cracking due to expansion and reaction with aggregate and increase in porosity and permeability, due to leaching of calcium hydroxide of concrete elements exposed to any environment. The applicant stated that this item is not applicable for containment concrete because the containment is a free-standing steel containment enclosed by a concrete shield building. The applicant further stated that concrete SCs associated with the steel containment were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66 using ingredients conforming to ACI and ASTM Standards. The applicant also stated that the concrete aggregates conformed to ASTM Specification C33 and were not reactive, based on results of tests conducted in accordance with requirements in ASTM C 289. The applicant further stated that aging management of concrete cracking due to expansion and reaction with aggregate and increase in porosity and permeability due to leaching of calcium hydroxide is performed under the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.1.10 against the criteria in SRP-LR Section 3.5.2.2.1.10, which state 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. The GALL Report recommends further evaluation if the aggregate was not evaluated for potential expansion/reaction due to reactivity with the cementitious materials and suggests ASME Section XI, Subsection IWL as the AMP. GALL Report Sections II.A2-3 and II.A2-6 note that an AMP for inaccessible concrete is not required if the concrete was constructed in accordance with the recommendations of ACI 201.2R-77.

In its review of components associated with item 3.5.1-15, the staff finds that the applicant's not applicable claim is acceptable because the containment is a steel vessel, and no concrete serves a pressure retaining function. For concrete SCs associated with containment, the staff noted that the aggregate materials were evaluated for reactivity in accordance with appropriate ASTM Standards, and the concrete was designed in accordance with ACI 318-63 and constructed using guidance provided in ACI 301-66. Recommendations provided in ACI 201.2R-77 for durable concrete are incorporated into ACI 318 and ACI 301. In addition, the applicant proposed to manage these aging effects using the Structures Monitoring Program. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15, and the staff's review of the further evaluation criteria for non-containment concrete is in SER Section 3.5.2.2.2.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which address several areas.

Aging of Structures Not Covered by Structures Monitoring Program. LRA Section 3.5.2.2.2.1 addresses aging of structures not covered by the Structures Monitoring Program.

(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

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-23, addresses cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for interior and above-grade exterior concrete elements of Groups 1–5, 7, and 9 structures. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. In the LRA, the applicant stated that this item is covered by the Structures Monitoring Program; therefore, no further evaluation is required. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(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

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-24, addresses increase in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack for interior and above-grade exterior concrete elements of Groups 1–5, 7, and 9 structures. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. In the LRA, the applicant stated that this item is covered by the Structures Monitoring Program; therefore, no further evaluation is required. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(3) Loss of Material Due to Corrosion for Groups 1–5, 7, and 8 Structures

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-25, addresses loss of material due to corrosion of steel components for Groups 1–5, 7, and 8 structures. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. In the LRA, the applicant stated that this item is covered by the Structures Monitoring Program; therefore, no further evaluation is required. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(4) Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1–5 and 7–9 Structures

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-26, addresses loss of material (scaling, cracking, and spalling) due to freeze–thaw in concrete elements for Groups 1–3, 5, and 7–9 structures. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program. During the review and onsite audit of the Structures Monitoring Program the staff found no supporting evidence or significant operating experience indicating that freeze-thaw is an issue; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(5) Cracking Due to Expansion and Reaction with Aggregates for Groups 1–5 and 7–9 Structures

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-27, addresses cracking due to reaction with aggregates for Groups 1–5 and 7–9 structures. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. In the LRA, the applicant stated that this item is covered by the Structures Monitoring Program. The applicant also stated, in the LRA, that the Davis-Besse design specifications require that the concrete aggregates conform to ASTM C 33 and the potential reactivity of aggregates be acceptable based on testing in accordance with "ASTM Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)," described in ASTM C 289. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(6) Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1–3 and 5–9 Structures

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-28, addresses cracks and distortion due to increased stress levels from settlement for Groups 1–3 and 5–9 structures. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. The applicant stated in the LRA that this item is not applicable and does not require further evaluation because, based on settlement analyses, it is estimated that the maximum settlements of Class I and Class II structures that are founded on bedrock will be less than $^1/_8$ inch and that settlements of Class I structures founded on till deposit and granular fill will be less than $^1/_4$ inch. The staff confirmed these claims, after a review of the USAR, which states that Class I and major Class II structures founded on bedrock are limited to a settlement of $^1/_8$ inch. Those founded on till deposit and granular fill are designed for a settlement of less than $^1/_4$ inch. In addition, the staff noted that the applicant's Structures Monitoring Program inspects for cracking, regardless of aging mechanism; therefore, the staff finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(7) Reduction in Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1–3 and 5–9 Structures

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-29, addresses reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations for Groups 1–3 and 5–9 structures. In the LRA, the applicant stated that this item is not applicable because porous concrete subfoundations were not used at Davis-Besse. The staff reviewed the USAR and confirmed that no porous concrete subfoundations are present at Davis-Besse; therefore, the staff finds the applicant's determination acceptable.

(8) Lock-up Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

LRA Section 3.5.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-30, addresses lock-up due to wear in Lubrite supports exposed to an air-indoor environment. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program or the IWF Program. In the LRA, the applicant stated that this item is not applicable and that it is covered by the Structures Monitoring Program and the ISI Program-IWF. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program and the ISI Program-IWF; therefore, it finds the applicant's determination acceptable. The staff's reviews of the applicant's Structures Monitoring and ISI Program-IWF are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.11, respectively.

Aging Management of Inaccessible Areas. LRA Section 3.5.2.2.2.2 addresses aging management of inaccessible areas (below-grade inaccessible concrete areas of Groups 1–3, 5, and 7–9 structures).

(1) 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.

LRA Section 3.5.2.2.2.2.1, associated with LRA Table 3.5.1, item 3.5.1-26, addresses loss of material (scaling, cracking, and spalling) of inaccessible concrete elements due to freeze-thaw. The GALL Report recommends further evaluation for plants located in areas having moderate to severe weathering conditions. In the LRA, the applicant stated that the concrete structures were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66. The applicant also stated that concrete constructed to these criteria has water-to-cement ratio less than 0.45, and entrained air between 3–6 percent. The applicant further stated that the Structures Monitoring Program is used to manage cracking and loss of material and that inspection of exposed above-grade concrete assumes that degradation of inaccessible concrete will be detected before a loss of intended function occurs. The applicant finally stated that operating experience has not identified significant loss of material or cracking due to freeze-thaw of below-grade structures. During the review and onsite audit of the Structures Monitoring Program, the staff found no supporting evidence or significant operating experience indicating that freeze-thaw is an issue; therefore, it finds the applicant's determination acceptable. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring and that the applicant's approach is consistent with the recommendations of the GALL Report, items III.A1-6 and III.A3-6. The staff's review of the applicant's Structures Monitoring Program is documented in SER Sections 3.0.3.2.15.

Based on the evaluation provided, the staff concludes that the applicant meets SRP-LR Section 3.5.2.2.2.2.1 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.2.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) Cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1–5 and 7–9 structures.

LRA Section 3.5.2.2.2.2.2, associated with LRA Table 3.5.1, item 3.5.1-27, addresses cracking due to reaction with aggregates for Groups 1–5 and 7–9 structures. The GALL Report states that further evaluation of this structure/aging effect combination for inaccessible areas is not necessary if examinations, performed in accordance with ASTM Standards C227 or C295, demonstrate that the aggregates are non-reactive. In the LRA, the applicant stated that this item does not require further evaluation because the structure/aging effect combination is covered by the Structures Monitoring Program, exposed concrete will be examined for age-related degradation when a below-grade in-scope concrete component becomes available, and the Davis-Besse design specifications require that the concrete aggregates conform to ASTM C 33 and the potential reactivity of aggregates be acceptable based on testing in accordance with "ASTM Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)," described in ASTM C 289. The LRA also states that the concrete SCs at Davis-Besse were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66, using ingredients conforming to ACI and ASTM Standards. Recommendations provided in ACI 201.2R-77 for durable concrete are incorporated into ACI 318 and ACI 301.

The staff reviewed the USAR and noted that aggregates were tested for reactivity in accordance with ASTM C289 as well as the GALL Report recommended standard, ASTM C227. The staff also noted that the applicant's concrete was constructed in accordance with the recommendations in ACI 201.2R. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program and that the applicant's approach is consistent with the recommendations of the GALL Report. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15. The staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the Structures Monitoring Program is acceptable because the applicant used the appropriate tests for aggregate reactivity, the aging effect is within the scope of the Structures Monitoring Program, and the concrete was constructed following the recommendations of ACI 201.2R.

Based on the evaluation provided, the staff concludes that the applicant met SRP-LR Section 3.5.2.2.2.2.2 criteria. For those AMR items that apply to LRA

Section 3.5.2.2.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) 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, associated with LRA Table 3.5.1, items 3.5.1-28 and 3.5.1-29, addresses 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 for Groups 1–3 and 5–9 structures. The GALL Report recommends no further evaluation if this activity and these aging effects are included in the scope of the applicant's Structures Monitoring Program, and a de-watering system is not used. In the LRA, the applicant stated that these items do not require further evaluation because the structure/aging effect combination is covered by the Structures Monitoring Program and, based on settlement analyses, it is estimated that the maximum settlements of Class I and Class II structures that are founded on bedrock will be less than $^{1}/_{8}$ in. and that settlements of Class I structures founded on till deposit and granular fill will be less than $^{1}/_{4}$ in.

The staff confirmed these numbers after a review of the USAR, which states that Class I and major Class II structures founded on bedrock are limited to a settlement of $^{1}/_{8}$ inch. Those founded on till deposit and granular fill are designed for a settlement of less than $^{1}/_{4}$ inch. In addition, the staff confirmed through a review of the USAR that the Davis-Besse does not have porous concrete subfoundations or a dewatering system. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program and that the applicant's approach is consistent with the GALL Report recommendations. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

Based on the evaluation provided, the staff concludes that the applicant met SRP-LR Section 3.5.2.2.2.2.3 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(4) Increase in porosity and permeability, cracking and 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.

LRA Section 3.5.2.2.2.2.4 associated with LRA Table 3.5.1, item 3.5.1-31, addresses below-grade concrete components exposed to a groundwater/soil environment, which are being managed for cracking, loss of material, and loss of bond due to aggressive chemical attack and corrosion of embedded steel. In the LRA the applicant stated the following:

- The below-grade environment is aggressive (i.e., chlorides greater than 500 ppm and sulfates greater than 1,500 ppm, the minimum groundwater pH is 6.9).
- Portions of the structures are located below the normal groundwater level.
- Exterior portions of plant structures located below the normal groundwater level have been provided with waterproofing, but water leakage, above and below grade, has been observed at the plant.

The LRA also states that, under the Structures Monitoring Program, raw water chemistry (i.e., pH, chlorides, and sulfates) will be collected at least once every 5 years and include seasonal variations, below-grade inaccessible concrete components will be monitored before and during the period of extended operation, an examination of an in-scope structure will be completed prior to the period of extended operation that addresses the concrete below the groundwater elevation, and when a below-grade concrete structural component becomes accessible through excavation, the exposed concrete surfaces will be examined for age-related degradation.

The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program and that the applicant's approach is consistent with the recommendations of the GALL Report for items III.A1-4, III.A1-5, III.A3-4, and III.A3-5. -During the review, the staff issued several RAIs (RAI B2.39-3 and associated followups) to verify that the applicant's examination of a normally inaccessible, in-scope structure will be adequate. The staff's review of the RAI responses and the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15. The staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the Structures Monitoring Program is acceptable because the applicant assumed the groundwater will remain aggressive and committed to conduct an examination of an in-scope, below-grade structure prior to the period of extended operation. The examination will provide information on whether or not the aggressive groundwater is degrading the concrete, and, if so, the degradation will be addressed under the applicant's corrective action plan.

Based on the programs identified, the staff concludes that the applicant's evaluation meets SRP-LR Section 3.5.2.2.2.2.4 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(5) 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

LRA Section 3.5.2.2.2.2.5 associated with LRA Table 3.5.1, item 3.5.1-32, addresses below-grade concrete components exposed to a flowing water or soil environment, which are being managed for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide. In the LRA, the applicant stated that the concrete SCs at Davis-Besse were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66 using ingredients conforming to ACI and ASTM Standards. Recommendations provided in ACI 201.2R-77 for durable concrete are incorporated into ACI 318 and ACI 301. The applicant also stated that aging management of concrete for increase in porosity and permeability due to leaching of calcium hydroxide is performed under the Structures Monitoring Program and that below-grade inaccessible concrete components will be monitored before and during the period of extended operation. The applicant further stated that an examination of an in-scope structure will be completed prior to the period of extended operation that addresses the concrete below the groundwater elevation, and when a below-grade concrete structural component becomes accessible through excavation, the exposed concrete surfaces will be examined for age-related degradation.

The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program and that the applicant's approach is consistent with the recommendations in GALL Report items III.A1-7, III.A5-7, and III.A3-7. During the review, the staff issued several RAIs (RAI B2.39-3 and associated followups) to verify that the applicant's examination of a normally inaccessible, in-scope structure will be adequate. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15. The staff finds that the applicant met the further evaluation criteria, and the applicant's proposal to manage aging using the Structures Monitoring Program is acceptable because the applicant committed to conduct an examination of an in-scope, below-grade structure prior to the period of extended operation. The examination will provide information on whether or not leaching of calcium hydroxide is degrading the concrete, and, if so, the degradation will be addressed under the applicant's corrective action plan.

Based on the programs identified above, the staff concludes that the applicant's evaluation meets SRP-LR Section 3.5.2.2.2.2.5 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. LRA Section 3.5.2.2.2.3, associated with LRA Table 3.5.1, item 3.5.1-33, addresses reduction of strength and modulus of concrete structures exposed to elevated temperatures. The GALL Report recommends further evaluation for any concrete elements that exceed the specified temperature limits of 150 ˚F general and 200 ˚F local. In the LRA, the applicant stated that this item is not applicable to in-scope Group 1, 3, and 5 concrete SCs because none of these concrete structures are exposed to temperatures above the GALL Report limits. The applicant also stated that for Group 4 concrete SCs, there are several localized areas in the upper regions of the containment internal structures that exceed the 150 ˚F general temperature limit and one of these areas exceeds the 200 ˚F local temperature limit. The LRA further stated that primary shield wall calculations addressed the effect that a bounding temperature of up to 207 ˚F would have on the mechanical properties of the reinforced concrete and concluded that the elevated temperature would not influence the capacity of the primary shield wall to support mechanical loading since the mechanical stresses in that area are low.

From the information presented in LRA Table 3.5-1, item 3.5.1-33, it is not clear to the staff what is the extent and location of the regions that currently experience general and local area temperatures above the GALL Report limits, the magnitude of the temperatures in these regions, and the potential impact on the concrete mechanical properties of the general and local temperatures being above the GALL Report limits.

By letter dated May 2, 2011, the staff issued RAI 3.5.2.2.2-1 requesting that the applicant provide additional information addressing the location and extent of regions impacted by general and local area temperatures exceeding GALL Report limits, the impact on concrete mechanical properties, and how these regions will be managed during the period of extended operation.

In its response dated June 17, 2011, the applicant stated that the upper 4 ft of the primary shield wall exceeds the GALL Report localized limit of 200 ˚F. The applicant stated that, in this area, the maximum local concrete temperature was calculated as 205 ˚F. The applicant further stated that a calculation had been done that shows that the affected area has low stresses, and the concrete will be fully capable of performing its functions.

The staff reviewed the applicant's response and found it acceptable because the applicant confirmed that the area affected was localized, and the applicant completed a calculation demonstrating that the elevated temperatures would not affect the ability of the concrete to perform its intended function. In addition the maximum temperature only minimally (5 ˚F) exceeds the GALL Report limit, and it occurs in a location with low stresses. Therefore, the Structures Monitoring Program will be adequate to detect any future degradation that may occur and additional further evaluation is unnecessary. The staff's concern described in RAI 3.5.2.2.2-1 is resolved.

Based on the evaluation provided, the staff concludes that the applicant meets SRP-LR Section 3.5.2.2.2.3 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Aging Management of Inaccessible Areas for Group 6 Structures</u>. LRA Section 3.5.2.2.2.4 addresses aging management of inaccessible areas for Group 6 structures (below-grade inaccessible concrete areas).

(1) 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 Group 6 structures.

LRA Section 3.5.2.2.2.4.1 associated with LRA Table 3.5.1, item 3.5.1-34, addresses below-grade concrete components exposed to a groundwater/soil environment, which are being managed for increase in porosity and permeability, cracking, loss of material, and loss of bond due to aggressive chemical attack and corrosion of embedded steel. In the LRA, the applicant stated the following:

- The below-grade environment is aggressive (i.e., sulfates greater than 1,500 ppm).
- Portions of the Group 6 structures are located below the normal groundwater level.
- Exterior portions of plant structures below the normal groundwater level have been provided with waterproofing, but water leakage, above and below grade, has been observed at the plant.

The LRA also states that these aging effects/mechanisms will be managed by the Water Control Structures Inspection Program. The LRA further states that, under the Structures Monitoring Program, raw water chemistry (i.e., pH, chlorides, and sulfates) will be collected at least once every 5 years and include seasonal variations, below-grade inaccessible concrete components will be monitored before and during the period of extended operation, an examination of an in-scope structure will be completed prior to the period of extended operation that addresses the concrete below the groundwater elevation, and when a below-grade concrete structural component becomes accessible through excavation, the exposed concrete surfaces will be examined for age-related degradation.

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 state that the GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas if the environment is aggressive. In the GALL Report, it is noted that for inaccessible areas of plants with non-aggressive groundwater/soil (i.e., pH greater than 5.5, chlorides less than 500 ppm, or sulfates less than 1,500 ppm), as a minimum, the following should be considered:

- examinations of the exposed portions of the below-grade concrete, when excavated for any reason
- periodic monitoring of below-grade water chemistry, including consideration of potential seasonal variations

The staff noted that since the applicant's water chemistry (i.e., pH, chlorides and sulfates) will be collected at least once every 5 years and include seasonal variations, below-grade inaccessible concrete components will be monitored before and during the period of extended operation, an examination of an in-scope structure will be completed prior to the period of extended operation that addresses the concrete below the groundwater elevation, and when a below-grade concrete structural component becomes accessible through excavation, the exposed concrete surfaces will be examined for age-related degradation. These aging effects/mechanisms will be managed by the Water Control Structures Inspection Program and the Structures Monitoring Program and, the requirements in GALL Report items III.A6-1 and III.A6-3 have been met; therefore, the applicant's approach is acceptable. A more detailed discussion of the staff's review of the adequacy of the applicant's aging management approach for these aging effects on inaccessible elements of reinforced concrete structures for Groups 1–3, 5, and 7–9 structures is documented in SER Section 3.5.2.2.2.2, "Aging of Inaccessible Areas, Item 4," which also applies to Group 6 structures. The staff's reviews of the applicant's Water Control Structures Inspection and Structures Monitoring Programs are documented in SER Sections 3.0.3.2.16 3.0.3.2.15, respectively.

Based on the programs identified above, the staff concludes that the applicant's evaluation meets SRP-LR Section 3.5.2.2.2.4.1 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.4.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) Loss of material (spalling, scaling) and cracking due to freeze-thaw that could occur in below-grade inaccessible concrete areas of Group 6 structures.

LRA Section 3.5.2.2.2.4.2, associated with LRA Table 3.5.1, item 3.5.1-35, addresses loss of material (scaling, cracking, and spalling) of inaccessible concrete elements due to freeze-thaw in Group 6 structures. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the concrete structures were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66. The applicant further stated that concrete constructed to these standards has a water-to-cement ratio less than 0.45, and entrained air between 3–6 percent. The applicant also stated that the Water Control Structures Inspection Program is used to manage cracking and loss of material, and under the Structures Monitoring Program, inspections of exposed above-grade concrete are used to assume that degradation of inaccessible concrete will be detected before a loss of intended function. Additionally, operating experience has not identified significant loss of material or cracking due to freeze-thaw of below-grade structures.

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 further evaluation is required for loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible areas of reinforced concrete structures for plants subjected to moderate to severe weathering conditions. In the GALL Report, further evaluation is recommended for plants located in areas having moderate to severe weathering conditions if the concrete does not have an air content of 3–6 percent and a water-to-cement ratio between 0.35 and 0.45.

The staff noted that since the applicant's concrete contains the appropriate air content and water-to-cement ratio, the Water Control Structures and Structures Monitoring Programs will be used for aging management, inspections of exposed above-grade concrete are used to provide reasonable assurances that degradation of inaccessible concrete will be detected before a loss of intended function, and operating experience has not identified significant loss of material or cracking due to freeze-thaw of below-grade structures, the requirements of GALL Report item III.A.6-5 have been met; therefore, the applicant's approach is acceptable. A more detailed discussion of the staff's review of the adequacy of the applicant's aging management approach for these aging effects on inaccessible elements of reinforced concrete structures is documented in SER Section 3.5.2.2.2.2, "Aging of Inaccessible Areas, Item 1," which also applies to Group 6 structures. The staff's reviews of the applicant's Water Control Structures Inspection and Structures Monitoring Programs are documented in SER Sections 3.0.3.2.16 and 3.0.3.2.15, respectively.

Based on the programs identified above, the staff concludes that the applicant's evaluation meets SRP-LR Section 3.5.2.2.2.4.2 criteria. For those AMR items that apply to LRA Section 3.5.2.2.2.4.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) 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.

LRA Section 3.5.2.2.2.4.3, associated with LRA Table 3.5.1, item 3.5.1-36, addresses cracking due to reaction with aggregates for Group 6 structures. The applicant addressed the further evaluation criteria of the SRP-LR by stating that concrete SCs at Davis-Besse were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66, using ingredients conforming to ACI and ASTM Standards. The applicant also stated that the concrete aggregates conformed to ASTM Specification C33 and were not reactive, based on results of tests conducted in accordance with requirements in ASTM C 289. The applicant further stated that aging management of concrete cracking due to expansion and reaction with aggregate is performed under the Water Control Structures Inspection 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 state that further evaluation for cracking due to expansion and reaction with aggregates in below-grade inaccessible areas of reinforced concrete structures is not necessary if examinations performed in accordance with ASTM Standards C227 or C295 demonstrate that the aggregates are non-reactive. For potentially reactive aggregate, aggregate-concrete reaction is not significant if the concrete was constructed in accordance with ACI 201.2R.

The staff noted that since the aggregate were non-reactive in accordance with ASTM C 289 and the Water Control Structures Inspection Program will be used for aging management, the requirements in GALL Report item III.A6-2 have been met. A more detailed discussion of the staff's review of the adequacy of the applicant's aging management approach for these aging effects on inaccessible elements of reinforced concrete structures is documented in SER Section 3.5.2.2.2.2, "Aging of Inaccessible Areas, Item 2." The staff's review of the applicant's Water Control Structures Inspection Program is documented in SER Section 3.0.3.2.16.

LRA Section 3.5.2.2.2.4.3 associated with LRA Table 3.5.1, item 3.5.1-37, addresses below-grade concrete components exposed to a flowing water or soil environment, which are being managed for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the concrete structures were designed in accordance with ACI 318-63 and constructed in accordance with ACI 301-66. The applicant further stated that concrete constructed in accordance with these standards has a water-to-cement ratio less than 0.45 and entrained air between 3–6 percent. The applicant also stated that the Water Control Structures Inspection Program is used to manage increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide, and under the Structures Monitoring Program, an examination of an in-scope structure will be completed prior to the period of extended operation that addresses the concrete below the groundwater elevation. When a below-grade concrete structural component becomes accessible through excavation, the exposed concrete surfaces will be examined for age-related degradation.

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 state that further evaluation for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible areas of reinforced concrete structures is not necessary if the concrete was constructed using the guidance in ACI 201.2R-77.

The staff noted that since the concrete was constructed in accordance with guidance in ACI 201.2R-77, and the Water Control Structures Inspection and Structures Monitoring Programs will be used for aging management, the requirements in GALL Report item III.A6-6 have been met; therefore, the applicant's approach is acceptable. A more detailed discussion of the staff's review of the adequacy of the applicant's aging management approach for this aging effect on inaccessible elements of reinforced concrete structures is documented in SER Section 3.5.2.2.2.2, "Aging of Inaccessible Areas, Item 5." The staff's reviews of the applicant's Water Control Structures Inspection and Structures Monitoring Programs are documented in SER Sections 3.0.3.2.16 and 3.0.3.2.15, respectively.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.4, item 3, criteria. For those AMR items that apply to LRA Sections 3.5.2.2.2.4.3, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion. LRA Section 3.5.2.2.2.5, associated with LRA Table 3.5.1, item 3.5.1-38, addresses cracking due to SCC and loss of material due to pitting and crevice corrosion for Group 7 and 8 stainless steel tank liners. The applicant stated that this item is not applicable because no stainless steel tank liners are included in the structural reviews for aging management and that tanks subject to an AMR are evaluated with the respective mechanical systems. The staff reviewed the LRA and confirmed that tank liners are included in the mechanical reviews for aging management; therefore, the staff finds acceptable the applicant's determination that further evaluation is not required

Aging of Supports Not Covered by the Structures Monitoring Program. LRA Section 3.5.2.2.2.6 addresses aging of supports not covered by Structures Monitoring Program.

(1) Loss of Material Due to General and Pitting Corrosion, for Groups B2–B5 Supports

LRA Section 3.5.2.2.2.6, associated with LRA Table 3.5.1, item 3.5.1-39, addresses loss of material due to general and pitting corrosion of Groups B2–B5 steel supports, welds, bolted connections, and support anchorage to building structure exposed to an air-indoor or outdoor environment. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. In the LRA, the applicant stated that this item does not require further evaluation because it is covered by the Structures Monitoring Program. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(2) Reduction in Concrete Anchor Capacity Due to Degradation of the Surrounding Concrete, for Groups B1–B5 Supports

LRA Section 3.5.2.2.2.6, associated with LRA Table 3.5.1, item 3.5.1-40, addresses reduction in anchor capacity due to local concrete degradation, service-induced cracking, or other concrete aging mechanisms for building concrete at locations of expansion and grouted anchors, grout pads, and support base plates for Groups B1–B5 supports exposed to an air environment. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. In the LRA, the applicant stated that this item does not require further evaluation because it is covered by the Structures Monitoring Program. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

(3) Reduction/Loss of Isolation Function Due to Degradation of Vibration Isolation Elements for Group B4 Supports

LRA Section 3.5.2.2.2.6, associated with LRA Table 3.5.1, item 3.5.1-41, addresses reduction of isolation function of non-metallic vibration isolation elements in an air environment. The GALL Report recommends further evaluation of this structure/aging effect combination only if it is not covered by the Structures Monitoring Program. By letter dated October 7, 2011, in response to Supplemental RAI OIN-382, the applicant revised the LRA and stated that this item does not require further evaluation because it is covered by the Structures Monitoring Program. The staff confirmed that the structure/aging effect combination is covered by the Structures Monitoring Program; therefore, it finds the applicant's determination acceptable. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

'Cumulative Fatigue Damage Due to Cyclic Loading. LRA Section 3.5.2.2.2.7, associated with LRA Table 3.5.1, item 3.5.1-42, addresses cumulative fatigue damage due to cyclic loading in component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3. The applicant stated that this AMR item is not applicable because, after conducting a review of its CLB, it did not identify any existing fatigue analyses for component support members, including anchor bolts and welds for Groups B1.1, B1.2, and B1.3. The staff's evaluations of the applicant's identification of TLAAs are documented in SER Section 4.1. The staff reviewed the applicant USAR and LRA Section 4 and confirmed that the applicant's CLB does not contain fatigue analyses identified as TLAAs, as required by 10 CFR 54.21(c)(1), for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3. Therefore, the staff finds the applicant's claim acceptable.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA Program, including procedures and administrative controls for AMPs.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.5.2-1 through 3.5.2-13, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-13, the applicant indicated, via notes F–J, that the combination of component type, material, environment, and AERM does not correspond to an item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, Note F indicates that the material for the AMR item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine if the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.5.2.3.1 Containment, Structures, and Components Supports—Containment (including Containment Vessel, Shield Building, and Containment Internal Structures)—Aging Management Review Results—LRA Table 3.5.2-1

In LRA Table 3.5.2-1, the applicant stated that stainless steel containment emergency sump recirculation valve enclosures and enclosure bellows, penetration bellows, and penetrations (mechanical and electrical containment boundary) exposed to air-indoor do not have an AERM but are managed by the ISI Program—IWE and 10 CFR Part 50, Appendix J Program. The AMR items cite generic note I and either plant-specific note 501 or plant-specific notes 501 and 502. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 502 states that the containment emergency sump recirculation valve enclosures and bellows are extensions of the containment pressure boundary, provide an essentially leak tight barrier, and are locally leak tested similar to containment penetration bellows that serve as containment pressure boundaries.

The staff reviewed the associated items in the LRA and confirmed that no aging effect is applicable for these components, materials, and environment combinations based on its review of the GALL Report, which states that stainless steel in an air-indoor environment has no aging effect.

The staff's evaluations of the applicant's ISI Program—IWE and 10 CFR Part 50, Appendix J Program are documented in SER Sections 3.0.3.1.10 and 3.0.3.1.1, respectively. The staff finds the applicant's proposal to manage aging using the ISI Program—IWE and 10 CFR Part 50, Appendix J Program acceptable because periodic visual inspections and leak rate tests are conducted to verify that the components will meet their intended function as a structural pressure barrier.

In LRA Table 3.5.2-1, the applicant stated that the stainless steel containment normal sump liners exposed to raw water are being managed for loss of material by the Structures Monitoring Program. The AMR item cites generic note J and plant-specific note 503. Plant-specific note 503 states that the containment normal sump is assumed to have a raw water environment for license renewal evaluation. Because system leakage can be from various sources and may contain contaminants, it is assumed that the waste liquid collected in the stainless steel lined sump can be aggressive, loss of material is an AERM for the sump, and the material and environment combination is not evaluated in the GALL Report Civil Chapters I or II.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for these components, materials, and environment combinations based on its review of the GALL Report, which states that stainless steel in a raw water environment may experience loss of material.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15. The staff finds the applicant's proposal to manage aging using the Structures Monitoring Program acceptable because periodic visual inspections to detect loss of material are conducted to verify that the components will meet their intended function.

In LRA Table 3.5.2-1, the applicant stated that the stainless steel refueling canal liner exposed to an air-indoor environment does not have an AERM but is managed by the Structures Monitoring and Boric Acid Programs. The AMR items cite generic note I and either plant-specific note 501 or 508. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 508 states that the refueling canal has experienced leakage through the refueling canal liner, the repair of the refueling canal leakage is processed by the Corrective Action program, and the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation.

The staff reviewed the associated item in the LRA and confirmed that no aging effect is applicable for these components, materials, and environment combination based on its review of the GALL Report, which states that stainless steel in an air-indoor environment has no aging effect. The staff also noted that the liner is exposed to borated water during RFOs, and the GALL Report states that stainless steel in a water environment may experience loss of material. However, the staff further noted that the applicant will inspect the refueling canal liner and adjacent concrete every 5 years (approximately every other RFO) for the effects of leakage due to the cycling of borated water during the transfer of new fuel and removal of spent fuel with the Structures Monitoring and Boric Acid Programs. The staff's evaluations of the applicant's Structures Monitoring and Boric Acid Programs are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.2, respectively.

The staff finds the applicant's proposal to manage aging using the Structures Monitoring and Boric Acid Programs acceptable because the Structures Monitoring Program conducts periodic visual inspections to detect loss of material or leakage, and the Boric Acid Program includes provisions to identify, inspect, examine, evaluate, and initiate corrective action to manage the effects of boric acid leakage on the external surfaces of SCs to verify that the components will meet their intended functions as a flood barrier and support. To address the applicant's operating experience with leakage through the refueling cavity liner, the staff issued RAI B.2.39-1. This RAI, including the staff's review and a summary of the RAI resolution, is discussed in the Structures Monitoring Program (SER Section 3.0.3.2.15).

In LRA Tables 3.5.2-1, 3.5.2-2, 3.5.2-5, 3.5.2-6, 3.5.2-7, 3.5.2-8, 3.5.2-9, 3.5.2-10, 3.5.2-11, 3.5.2-12, 3.5.2-13 and 3.5.2-14, the applicant stated that the concrete containment normal sump, containment vessel emergency sump, incore tunnel, primary shield wall, reactor cavity missile shield, reinforced concrete (walls, floors, and ceilings), secondary shield wall, auxiliary feedpump turbine exhaust, cask pit, fuel transfer pit, new fuel storage pit, pipe tunnel, roof penthouses, SFP, CSTs foundations, sumps, BWST pipe trench and its hatch cover, cable trenches and their top slabs, manhole missile shields, manholes, equipment pads, flood curbs, turbine generator pedestal, and support pedestals exposed to air-indoor do not have an AERM but are managed by the Structures Monitoring Program. The AMR items cite generic note I and plant-specific note 501. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Structures Monitoring Program acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted to verify that the components will meet their intended functions. In addition, visual inspections under the Structures Monitoring Program are the appropriate approach to manage aging of concrete components in accordance with the GALL Report. The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

In LRA Table 3.5.2-1, the applicant stated that the concrete shield building emergency air lock enclosure and dome exposed to an air-indoor environment do not have an AERM but are managed by the Structures Monitoring and 10 CFR Part 50, Appendix J Programs. The AMR items cite generic note I and plant-specific notes 501 and 511. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 511 states that, in addition to aging management by the Structures Monitoring Program, the shield building concrete is also managed by the 10 CFR Part 50, Appendix J Program's containment vessel and shield building visual inspection.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Structures Monitoring and 10 CFR Part 50, Appendix J Programs acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96, in conjunction with periodic leakage rate testing, are conducted to verify that the components will meet of their intended functions. The staff's evaluations of the applicant's Structures Monitoring and 10 CFR Part 50, Appendix J Programs are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.1, respectively.

In LRA Table 3.5.2-1, the applicant stated that the concrete shield building walls (above and below grade) exposed to an air-indoor environment do not have an AERM but are managed by the Structures Monitoring, 10 CFR Part 50, Appendix J, and Fire Protection Programs. The AMR items cite generic note I and plant-specific notes 501, 511, and 512. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 511 states that in addition to aging management by the Structures Monitoring Program, the shield building concrete is also managed by the 10 CFR Part 50, Appendix J Program's containment vessel and shield building visual inspection. Plant-specific note 512 states that concrete walls, floors, and ceilings with fire barrier intended function receive additional inspection as part of the Fire Protection Program.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Structures Monitoring, 10 CFR Part 50, Appendix J, and Fire Protection Programs acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96, in conjunction with periodic leakage rate testing, are conducted as well as additional tests and inspections in accordance with NRC regulations and applicable NRC and NFPA recommendations to verify that the components will meet their intended functions. The staff's evaluations of the applicant's Structures Monitoring, 10 CFR Part 50, Appendix J, and Fire Protection Programs are documented in SER Sections 3.0.3.2.15, 3.0.3.1.1, and 3.0.3.2.7, respectively.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Containment, Structures, and Components Supports—Auxiliary Building—Aging Management Review Results—LRA Table 3.5.2-2

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

In LRA Tables 3.5.2-2, 3.5.2-7, and 3.5.2-12, the applicant stated that the concrete roof slabs (auxiliary building) and roofs (missile shield building, diesel oil pump house, and relay house), exposed to an air-indoor environment do not have an AERM but are managed by the Structures Monitoring Program. The AMR items cite generic note I and either plant-specific notes 501 or 518. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 518 states that the roof has built-up roofing; therefore, the environment for this concrete roof slab is air-indoor for the underside of the slab, and the roof membrane is evaluated and addressed in bulk commodities.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Structures Monitoring Program acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted of the underside of the auxiliary building concrete roof slab exposed to air-indoor, and the exterior built-up side of the roof slabs is evaluated and addressed under bulk commodities to verify that the component will meet its intended function(s). The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

In LRA Tables 3.5.2-2, 3.5.2-6, 3.5.2-8, 3.5.2-10, and 3.5.2-13, the applicant stated that the reinforced concrete (walls, floors, and ceilings, hatches and hatch plugs) exposed to an air-indoor environment do not have an AERM but are managed by the Structures Monitoring and Fire Protection Programs. The AMR items cite generic note I and plant-specific notes 501, 512, and 515. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 512 states that concrete walls, floors, and ceilings with a fire barrier function receive additional inspection as part of the Fire Protection Program. Plant-specific note 515 states that lead is used for radiation shielding only and is not relied upon as a structural element; lead is protected within steel panels, masonry walls, or concrete plugs; radiation shielding panels have lead bricks or lead panels protected with steel plates; lead bricks are sandwiched within reinforced masonry walls; temporary lead blankets are hung on steel supports; lead plates are installed between concrete hatch plugs; and lead shot, covered with steel panels, is used to fill trenches containing radioactive piping.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Structures Monitoring Program and Fire Protection Program acceptable because, under the Structures Monitoring Program, periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted to verify that the components will meet their intended function as structural supports. Additionally, under the Fire Protection Program, tests and inspections are conducted in accordance with NRC regulations and the applicable NRC and NFPA recommendations to verify that the components will meet their intended function(s). The staff's evaluations of the applicant's Structures Monitoring Program and Fire Protection Program are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.7, respectively.

In LRA Table 3.5.2-2, the applicant stated that the spent fuel rack neutron absorbers exposed to a treated water environment are being managed for loss of material by the Boral® Monitoring and PWR Water Chemistry Programs. The AMR item cites generic note J and plant-specific note 520. Plant-specific note 520 states that the listed AMP is a plant-specific program for this item, and Davis-Besse plant-specific AMR concluded Boral® does not require aging management for the period of extended operation for its neutron absorbing function; however, because of recent industry experience, a new Boral® Monitoring Program will be instituted at Davis-Besse for the period of extended operation, and aging management for loss of material of its aluminum constituent is required.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because Boral® components of the SFP rack neutron absorbers that are exposed to treated borated water can experience loss of material.

The staff's evaluations of the applicant's Boral® Monitoring and PWR Water Chemistry Programs are documented in SER Sections 3.0.3.3.2 and 3.0.3.1.15, respectively. The staff finds the applicant's proposal to manage aging using the Boral® Monitoring Program acceptable because the program will be implemented prior to the period of extended operation, measurements from insitu neutron attenuation tests will be performed and compared to previous test results to determine whether degradation is occurring, and in-situ testing will be used to determine changes in physical properties of the Boral®. Furthermore, the PWR Chemistry Program is a mitigation program that monitors and controls detrimental contaminants that can lead to loss of material, cracking, and reduction in heat transfer. This meets the recommendations provided in the GALL Report, item VII.A2-5.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.3 Containment, Structures, and Components Supports—Intake Structure, Forebay, and Service Water Discharge Structure—Aging Management Review Results—LRA Table 3.5.2-3

In LRA Table 3.5.2-3, the applicant stated that for the reinforced concrete (walls, floors, and ceilings) exposed to an air-indoor environment, there are no AERMs, but they are managed by the Water Control Structures Inspection and Fire Protection Programs. The AMR item cites generic note I and plant-specific notes 501, 522, and 512. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 522 states that Davis-Besse is not committed to RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants, Revision 1." However, the Water Control Structure Inspection Program, as implemented by the Structures Monitoring Program, will be enhanced to include applicable inspection elements delineated in RG 1.127, Revision 1, per NUREG-1801, Chapter XI.S7. Plant-specific note 512 states that concrete walls, floors, and ceilings with a fire barrier function receive additional inspection as part of the Fire Protection Program.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Water Control Structures and the Fire Protection Programs acceptable because the Water Control Structures Inspection Program is implemented as part of the Structures Monitoring Program and will conduct periodic visual inspections at intervals not to exceed 5 years using guidance provided in ACI 349.3R-96 to verify that the components will meet one or more of their intended functions as a structural support, missile barrier, shelter or protection, and flood barrier. Additionally, under the Fire Protection Program, tests and inspections are conducted in accordance with the applicable NFPA recommendations to verify that the components will meet their intended function as a fire barrier. The staff's evaluations of the Water Control Structures Inspection and Fire Protection Programs are documented in SER Sections 3.0.3.2.16 and 3.0.3.2.7, respectively.

In LRA Table 3.5.2-3, the applicant stated that for the concrete sump exposed to an air-indoor environment, there are no AERMs, but it is managed by the Water Control Structures Inspection Program. The AMR item cites generic note I and plant-specific notes 501 and 522. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation. Plant-specific note 522 states that Davis-Besse is not committed to RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants, Revision 1." However, the Water Control Structure Inspection Program, as implemented by the Structures Monitoring Program, will be enhanced to include applicable inspection elements delineated in RG 1.127, Revision 1, per NUREG-1801, Chapter XI.S7.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using the Water Control Structures Inspection Program acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted to verify that the components will meet their intended function as structural or functional support. The staff's evaluation of the Water Control Structures Program is documented in SER Section 3.0.3.2.16.

In LRA Table 3.5.2-3, the applicant stated that the earthen forebay (including riprap) exposed to an air-outdoor environment is being managed for loss of form and loss of material by the Water Control Structures Inspection Program. The AMR cites generic note G.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because the earthen forebay (including riprap) is subjected to an air-outdoor environment that can result in loss of material and loss of form, as discussed in the GALL Report, item III.A6-9. The staff finds the applicant's proposal to manage aging using the Water Control Structures Inspection Program for the earthen forebay (including riprap) that is exposed to air-outdoor acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted to verify that the components will meet their intended functions. In addition, this is the appropriate AMP for this aging effect in accordance with the GALL Report. The staff's evaluation of the Water Control Structures Inspection Program is documented in SER Section 3.0.3.2.16.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.4 Containment, Structures, and Components Supports—Borated Water Storage Tank Level Transmitter Building—Aging Management Review Results—LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the BWST level transmitter building component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the BWST level transmitter building component groups are consistent with the GALL Report.

3.5.2.3.5 Containment, Structures, and Components Supports—Miscellaneous Diesel Generator Building—Aging Management Review Results—LRA Table 3.5.2-5

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.6 Containment, Structures, and Components Supports—Office Building (Condensate Storage Tanks)—Aging Management Review Results—LRA Table 3.5.2-6

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for reinforced concrete walls and ceilings exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring and Fire Protection Programs for verifying the lack of aging, is documented in SER Section 3.5.2.3.2.

In LRA Table 3.5.2-6, the applicant stated that for porcelain window wall panels exposed to indoor or outdoor air, there is no aging effect, and no AMP is proposed. The AMR items cite generic note I and plant-specific note 0549, which state that the porcelain window wall panels are an architectural feature that serve a shelter intended function for the CST room and that a review of site-specific and industry operating experience has not identified any aging effects that would affect or challenge the intended function of these components.

The staff reviewed the associated items in the LRA and confirmed that no credible aging effects are applicable for this component, material, and environment combination based on its review of related GALL Report lines and manufacturers' information. The staff noted that the only AMR results in the GALL Report directly related to porcelain are for electrical insulators where the environmental stressors and relevant aging effects are different from those for window wall panels exposed to indoor and outdoor air. The staff also noted that the GALL Report includes AMR results for glass piping elements in a variety of environments, including air, treated water, and raw water and that for these AMR results, the GALL Report states that there is no aging effect, and no AMP is recommended. The staff further noted that the surfaces of porcelain window wall panels exposed to indoor and outdoor air are a vitreous enamel material similar to glass, with good thermal, chemical, and wear resistance for these environments. Based on the similarity of porcelain to glass and the lack of ambient environmental stressors to cause degradation of the window wall panel surfaces, the staff finds the applicant's determination that there are no aging effects for porcelain window wall panels exposed to indoor or outdoor air to be acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.7 Containment, Structures, and Components Supports—Personnel Shop Facility Passageway (Missile Shield Area)—Aging Management Review Results—LRA Table 3.5.2-7

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for concrete roof slabs exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.2.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.8 Containment, Structures, and Components Supports—Service Water Pipe Tunnel and Valve Rooms—Aging Management Review Results—LRA Table 3.5.2-8

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for reinforced concrete walls and ceilings exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring and Fire Protection Programs for verifying the lack of aging, is documented in SER Section 3.5.2.3.2.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.9 Containment, Structures, and Components Supports—Station Blackout Diesel Generator Building (including Transformer X-3051 and Radiator Skid Foundations)—Aging Management Review Results—LRA Table 3.5.2-9

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.10 Containment, Structures, and Components Supports—Turbine Building—Aging Management Review Results—LRA Table 3.5.2-10

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for reinforced concrete walls and ceilings exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring and Fire Protection Programs for verifying the lack of aging, is documented in SER Section 3.5.2.3.2.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.11 Containment, Structures, and Components Supports—Water Treatment Building—Aging Management Review Results—LRA Table 3.5.2-11

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.12 Containment, Structures, and Components Supports—Yard Structures—Aging Management Review Results—LRA Table 3.5.2-12

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for concrete roof slabs exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.2.

In LRA Table 3.5.2-12, the applicant stated that the carbon steel EDG fuel oil tank hold down restraints exposed to structural backfill do not have an AERM but are managed by the Structures Monitoring Program. The AMR item cites generic note G and plant-specific note 531. Plant-specific note 531 states that NUREG-1801 does not list a structural backfill environment for steel components. No AERMs were identified for the EDG fuel oil storage tank hold down wire rope in a structural backfill environment. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation. The structural backfill is above-grade, and the elevation location of the wire rope is above the site's groundwater elevation.

The staff reviewed the associated items in the LRA and noted that the applicant did not reference an AERM for these components, materials, and environment combinations. Although the staff agrees that the Structures Monitoring Program is an acceptable AMP for the carbon steel hold down wire rope, the staff is unclear why loss of material due to corrosion was not identified as an AERM. By letter dated May 2, 2011, the staff issued RAI 3.5.2.3.12-1 requesting that the applicant justify why it did not list loss of material as an AERM and explain how the Structures Monitoring Program will monitor aging of components in structural backfill.

In it response dated June 3, 2011, the applicant stated that loss of material was not an applicable aging effect and referenced a study that demonstrated that corrosion observed on steel piles driven into undisturbed soil is not sufficient to affect the strength of the pilings as load bearing structures. The applicant also stated that the Structures Monitoring Program will monitor aging of components in structural backfill during opportunistic inspections.

The staff reviewed the applicant's response and found it unacceptable. The staff does not agree that the referenced study regarding piles in undisturbed soil applies to wire rope restraints in structural backfill. Undisturbed soil has low oxygen levels, which may limit corrosion. These conditions may not be present in structural backfill. In addition, the portion of Commitment No. 20 discussing opportunistic inspections only mentions concrete components. Therefore, by letter dated July 21, 2011, the staff issued followup RAI 3.5.2.3.12-3 requesting the applicant propose an appropriate AMP to manage loss of material for the wire rope restraints.

By letter dated August 17, 2011, the applicant responded and explained that the steel restraints were used to restrain the tanks during plant construction before backfill was placed over the tanks. Once construction was completed, the restraints were no longer needed; therefore, the restraints have no CLB function and should not have been in-scope for license renewal. The applicant further stated that the LRA was revised to remove the restraints from scope. The staff reviewed the applicant's response and found it acceptable because the restraints do not serve a CLB function and were incorrectly included within the scope of license renewal. The staff's concerns described in RAIs 3.5.2.3.12-1 and 3.5.2.3.12-3 are resolved.

In LRA Table 3.5.2-12, the applicant stated that galvanized steel wave protection dike corrugated pipe casings and carbon steel wave protection dike piles exposed to structural backfill are managed for loss of material by the Structures Monitoring Program. The AMR item cites generic note H and plant-specific note 532. Plant-specific note 532 states that the wave protection dike corrugated pipe casings and wave protection dike piles buried in the wave protection dikes can be exposed to groundwater since the corrugated pipe casings are located below site groundwater elevation. Since these buried steel components can be in direct contact with groundwater, a raw water environment is conservatively used for aging evaluation.

The staff reviewed the associated items in the LRA and noted that the applicant stated that the Structures Monitoring Program will be used to manage galvanized steel wave protection dike corrugated pipe casings and carbon steel wave protection dike piles exposed to structural backfill for loss of material. It is unclear to the staff how these components will be inspected under the Structures Monitoring Program to demonstrate that this AERM is being effectively managed since the Structures Monitoring Program in large measure is a visual inspection program. Therefore, by letter dated May 2, 2011, the staff issued RAI 3.5.2.3.12-2 asking the applicant to explain how the Structures Monitoring Program would be used to manage this AERM.

In its response dated June 3, 2011, the applicant explained that the components are installed on both sides of a piping system that is subjected to the Buried Piping and Tank Inspections Program. Both this program and the Structures Monitoring Program have requirements for opportunistic inspections that would identify degradation of the components.

The staff reviewed the applicant's response and found it unacceptable. Although the staff believes opportunistic inspections are appropriate for buried concrete when the groundwater is non-aggressive, the staff does not agree this approach is adequate for steel components in structural backfill with aggressive groundwater. In addition, the portion of Commitment No. 20 discussing opportunistic inspections does not discuss buried steel components. Therefore, by letter dated July 21, 2011, the staff issued followup RAI 3.5.2.3.12-4 requesting the applicant explain why opportunistic inspections are adequate to detect loss of material of steel components in structural backfill exposed to aggressive groundwater or propose an appropriate AMP to manage loss of material for the components.

By letter dated August 26, 2011, the applicant stated that steel components in structural backfill exposed to aggressive groundwater would be managed for loss of material by focused inspection as part of the Structures Monitoring Program (Commitment No. 20). The applicant stated that the inspection would expose pipe for inspection prior to the period of extended operation. The applicant further explained that the results of the inspection would be used to determine the need and interval for future inspections. The applicant also stated that these structures were installed in 1988.

The staff reviewed the applicant's response and found it acceptable. The staff noted that the components in question were installed in 1988 and will have been in service approximately 30 years when they are inspected prior to the period of extended operation (2017). The staff finds the applicant's aging management approach acceptable because a focused visual inspection will be conducted prior to the period of extended operation. As discussed in the GALL Report, this inspection method is appropriate for detecting loss of material in steel components. The staff finds one initial inspection is appropriate because the components will have been exposed to the environment for 30 years, and if no degradation is detected, it provides reasonable assurance that no significant degradation will occur during the period of extended operation. If degradation is detected, the applicant will enter it into the Corrective Action Program and determine the need for future examinations. The staff's concerns in RAIs 3.5.3.3.12-2 and 3.5.3.3.12-4 are resolved.

In LRA Table 3.5.2-12, the applicant stated that the earthen wave protection dikes (including riprap) and EDG fuel oil storage tanks backfill exposed to air-outdoor is being managed for loss of form by the Structures Monitoring Program. The AMR cites generic note G.

The staff reviewed the associated items in the LRA and confirmed that the applicant identified the correct aging effects for this component, material, and environment combination because the earthen wave protection dikes (including riprap) and EDG fuel oil storage tanks backfill is subjected to an air-outdoor environment that can result in loss of form, as discussed in the GALL Report, item III.A6-9.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.15. The staff finds the applicant's proposal to manage aging using the Structures Monitoring Program for the earthen wave protection dikes (including riprap) and EDG fuel oil storage tanks backfill that is exposed to an air-outdoor environment acceptable because periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted to verify that the components will meet their intended functions as flood protection barrier, shelter or protection, missile barrier, and structural or functional support.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds, that the applicant demonstrated that the effects of aging of these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.13 Containment, Structures, and Components Supports—Bulk Commodities—Aging Management Review Results—LRA Table 3.5.2-13

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for reinforced concrete walls and ceilings exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring and Fire Protection Programs for verifying the lack of aging, is documented in SER Section 3.5.2.3.2.

In LRA Tables 3.5.2-13, the applicant stated that the stainless steel pipe supports exposed to treated water will be managed for loss of material by the Structures Monitoring Program and the PWR Chemistry Program. The AMR item cites generic note J and plant-specific note 545, which state that these stainless steel supports in the SFP are not within the scope of ISI—IWF Program and that the Structures Monitoring Program and the PWR Chemistry Program will be used to manage the aging effects for the period of extended operation.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. Based on its review of the GALL Report, item III.B1.1-11, which states that support members made of steel or stainless steel; welds; bolted connections; and support anchorage to building structures exposed to treated water with temperatures less than 140 °F (60 °C) experience loss of material due to general (steel only), pitting, and crevice corrosion aging effects, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's Structures Monitoring Program and PWR Chemistry Program are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.15, respectively. The staff finds the applicant's proposal to manage aging using the Structures Monitoring Program and PWR Water Chemistry Program acceptable because under the Structures Monitoring Program, periodic visual are conducted to verify that the components will meet their intended functions. Additionally, the PWR Water Chemistry Program is a mitigation program that monitors and controls detrimental contaminants that can lead to loss of material, cracking, and reduction in heat transfer. The applicant also noted, in LRA Table 3.5.1-49, that the stainless steel pipe supports are part of the SFP and are not within the scope of the ISI Program—IWF.

In LRA Table 3.5.2-13, the applicant stated that waterstops, waterproofing membrane, and elastomer expansion boots in a soil or air-indoor environment do not have an AERM but are managed by the Structures Monitoring Program. The AMR items cite generic note J and plant-specific note 543. Plant-specific note 543 states that no appreciable aging effects have been identified for the component type. However, Davis-Besse operating experience indicates groundwater in-leakage. Therefore, elastomer seals below grade and waterstops require management when accessible.

The staff reviewed the associated items in the LRA and does not agree that the material and environment combination does not have associated aging effects. However, the staff finds the applicant's proposal to manage aging using opportunistic inspections under the Structures Monitoring Program acceptable because opportunistic inspections are appropriate to detect aging of normally inaccessible waterstops. In addition, to address the applicant's operating experience with groundwater infiltration, the staff issued several RAIs (RAI B2.39-3 and associated followups) to verify that the applicant is appropriately managing aging of in-scope structures exposed to infiltration. The staff's review of the RAI responses and the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15.

In LRA Table 3.5.2-13, the applicant stated that galvanized steel fire doors in an air-indoor environment do not have an AERM but are managed by the Structures Monitoring and Fire Protection Programs. The AMR items cite generic note I and plant-specific note 501. Plant-specific note 501 states that no applicable aging effect has been identified for the component type; however, the identified AMP or AMPs will be used to confirm the absence of significant aging effects for the period of extended operation.

The staff reviewed the associated items in the LRA and confirmed that no credible aging effect is applicable for these components, materials, and environment combinations based on its review of the GALL Report, which states that galvanized steel exposed to an air-indoor environment has no aging effect.

The staff's evaluations of the applicant's Structures Monitoring Program and Fire Protection Program are documented in SER Sections 3.0.3.2.15 and 3.0.3.2.7, respectively. The staff finds the applicant's proposal to manage aging using the Structures Monitoring Program and Fire Protection Program acceptable because under the Structures Monitoring Program, periodic visual inspections using guidance provided in ACI 349.3R-96 are conducted to verify that the components will meet their intended function as structural or functional support. Additionally, under the Fire Protection Program, tests and inspections are conducted in accordance with the applicable NFPA recommendations to verify that the components will meet their intended function as a fire barrier.

In LRA Table 3.5.2-13, the applicant stated that aluminum jacketing used for piping and mechanical equipment insulation in an air-indoor or air-outdoor environment is managed for loss of material due to boric acid corrosion by the Boric Acid Corrosion Program. The AMR items cite generic note J and plant-specific note 504. Plant-specific note 504 states that the aging mechanism applies to areas that contain borated water.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that the applicant also addressed loss of material due to pitting and crevice corrosion for this component, material, and air-outdoor environment combination in AMR items listed in LRA Table 3.5.2-13, the evaluation of which follows immediately below. Based on its review of SRP-LR and GALL Report recommendations, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Boric Acid Corrosion Program is documented in SER Section 3.0.3.1.2 The staff finds the applicant's proposal to manage aging using the Boric Acid Corrosion Program acceptable because LRA Table 3.5.2-13 references GALL Report (Revision 1), items III.B2-6, III.B3-4, III.B4-6, and III.B5-4, for this commodity/component, which identifies the Boric Acid Corrosion (XI.M10) as the AMP for this component, material, and environment combination. Therefore, no further evaluation is required.

In LRA Tables 3.5.2-13, the applicant stated that stainless steel mirror piping and mechanical equipment insulation in an air-outdoor environment are managed for loss of material by the Structures Monitoring Program. The AMR items cite generic note J.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of components, materials, and environment. Based on its review of SRP-LR and GALL Report recommendations, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.15. The staff finds the applicant's proposal to manage aging using the Structures Monitoring Program acceptable because under the Structures Monitoring Program, periodic visual inspections are conducted to verify that the components will meet their intended function. GALL Report, items III.B2-7 and III.B4-7 and Table 3.5.1-50, referenced in the LRA for the commodity/component, identify the Structures Monitoring Program (XI.S6) as the AMP for this component, material, and environment combination. Since this meets the recommendations provided in the GALL Report, items III.B2-7 and III.B4-7, no further evaluation is required.

In LRA Table 3.5.2-13, the applicant stated that aluminum jacketing used as insulation for piping and mechanical equipment exposed to indoor air is being managed for loss of material due to boric acid corrosion by the Boric Acid Corrosion Program. The applicant also stated that aluminum jacketing exposed to outdoor air is being managed for loss of material due to boric acid corrosion by the Boric Acid Corrosion Program and loss of material due to pitting and crevice corrosion by the Structures Monitoring Program. The AMR items cite generic note J and plant-specific note 0504 (for items associated with boric acid corrosion), stating that the aging mechanism applies to areas that contain borated systems.

The GALL Report addresses aluminum components exposed to indoor air in GALL Report item II.B5-2 (TP-8), which states that there are no aging effects, aging mechanisms, or AMPs; however, the applicant identified the additional boric acid environment. The staff noted that GALL Report, item VII.A3-4 (AP-1), addresses aluminum components exposed to air with borated water leakage, which should be managed for loss of material due to boric acid corrosion by the Boric Acid Corrosion Program. Based on this GALL Report guidance and on its review of Uhlig’s Corrosion Handbook, 2nd Edition, which states that boric acid solutions have a negligible effect on aluminum alloys, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The GALL Report, item II.B2-7 (TP-6), addresses aluminum components exposed to outdoor air, which are being managed for loss of material due to pitting and crevice corrosion by the Structures Monitoring Program. Based on this GALL Report guidance and the loss of material due to boric acid discussion above, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff’s evaluations of the applicant’s Boric Acid Corrosion Program and Structures Monitoring Program are documented in SER Sections 3.0.3.1.2 and 3.0.3.2.15, respectively. The staff finds the applicant’s proposal to manage loss of material due to boric acid corrosion using the Boric Acid Corrosion Program acceptable because the program includes frequent monitoring for potential boric acid leakage and timely repair if leakage is detected. The staff also finds the applicant’s proposal to manage aging using the Structures Monitoring Program acceptable because the program includes periodic visual inspection to monitor for loss of material.

In LRA Table 3.5.2-13, the applicant stated that for stainless steel piping and mechanical equipment mirror insulation exposed to air-indoor, there is no aging effect, and no AMP is proposed. The AMR item cites generic note J.

The staff reviewed the associated items in the LRA and confirmed that no credible aging effects are applicable for this component, material, and environment combination based on its review of GALL Report, item VIII.I-10, in which there are no aging effects identified and no AMPs recommended for stainless steel piping, piping components, and piping elements exposed to air-indoor uncontrolled (external). The staff noted that although stainless steel mirror insulation is not specifically cited in GALL Report item VIII.I-10, the degradation mechanisms for stainless steel mirror insulation will be the same as for stainless steel piping, piping components, and piping elements exposed to indoor air.

In LRA Table 3.5.2-13, the applicant stated that Isolatek Mandoseal and Monokote fireproofing and ceramic fiber and 3M Interam fire wraps exposed to air-indoor are being managed for loss of material, cracking, and delamination by the Fire Protection Program. The AMR items cite generic note J.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that Mandoseal is a cementitious fireproof coating made with vermiculite and cement (www.findownersearch.com), Monokote is a gypsum-based cementitious spray-applied fireproofing (www.na.graceconstruction.com), and 3M Interam is a flexible aluminosilicate fire barrier mat surrounded by a metal foil (NUREG-1924). The staff also noted that all of these materials are constructed of industry standard fire proofing materials that are designed for use indoors with minimal aging effects but that they could experience loss of material, cracking, and delamination. Based on its review of NUREG-1924 and online resources, the staff finds that the applicant identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Fire Protection Program is documented in SER Section 3.0.3.2.7. The staff finds the applicants' proposal to manage aging using the Fire Protection Program acceptable because the program includes periodic visual inspections, which can identify loss of material, cracking, and delamination of the fireproofing materials that could result in a loss of the component intended function.

In LRA Table 3.5.2-13, the applicant stated that for galvanized steel fire doors exposed to air-indoor, there are no aging effects but that aging will be managed by the Fire Protection and Structures Monitoring Programs. The AMR items cite generic note I. The AMR items also cite plant-specific note 0501, which states that no applicable aging effects have been identified for the component type but that the identified AMPs will be used to confirm the absence of significant aging effects for the period of extended operation.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all the credible aging effects for this combination of component, material, and environment. The staff noted that SRP-LR Table 3.3-2, item 63, recommends GALL Report AMP XI.M27, "Fire Protection," to manage loss of material for steel fire rated doors exposed to indoor or outdoor air. The staff also noted that the GALL Report's definition of steel includes galvanized steel. Based on its review of the GALL Report, the staff does not agree that galvanized steel fire rated doors do not have any aging effects. However, the staff further noted that the GALL Report identified aging effects are included in the scope of the programs the applicant cited to manage aging for these components; therefore, loss of material will be effectively managed during the period of extended operation.

The staff's evaluation of the applicant's Fire Protection and Structures Monitoring Programs are documented in SER Sections 3.0.3.2.7 and 3.0.3.2.15, respectively. The staff finds the applicant's proposal to manage aging using the Fire Protection and Structures Monitoring Programs acceptable because these programs include periodic visual inspections that can identify loss of material, which is consistent with the GALL Report recommended aging effect and AMP for this component, material, and environment combination.

In LRA Table 3.5.2-13, the applicant stated that for fiberglass containment penetration insulation and for calcium silicate or fiberglass piping and mechanical equipment insulation exposed to indoor or outdoor air, there is no aging effect, and no AMP is proposed. The AMR items cite generic note J.

The staff noted that fiberglass and calcium silicate insulation is commonly used at nuclear power plants and that the applicant credited the insulation as nonsafety-related components supporting safety-related components. The staff also noted that in a dry environment, without potential for water leakage, spray, or condensation, fiberglass and calcium silicate are expected to be inert to environmental effects. The staff further noted that both fiberglass and calcium silicate insulation have potential for prolonged retention of any moisture to which they are exposed, and prolonged exposure to moisture may increase thermal conductivity, thereby degrading the insulating characteristics.

By letter dated May 2, 2011, the staff issued RAI 3.5.2.3.13-1, requesting that for those insulation components in LRA Table 3.5.2-13 with a function to limit heat transfer, the applicant state how the configuration of the jacketing ensures that it is properly installed so as to prevent water intrusion into the insulation (e.g., seams on the bottom, overlapping seams) such that aging management is not required.

In its response dated June 3, 2011, the applicant stated that its AMR process did not include a review of in-room heat-up analyses to identify specific credited thermal insulation but that it included all piping and mechanical equipment insulation for AMR. The applicant also stated that its specification for installation of insulation includes the following features to ensure that insulation jacketing is installed properly to prevent water intrusion into the insulation:

- Aluminum jacketing for piping sizes up to 10 inches is required to have a 2-in. overlap and, for piping sizes above 10 in., is required to have a 3-in. overlap.
- Longitudinal jacketing joints on horizontal runs of piping is lapped downward with the joint located approximately 45 degrees off the bottom to shed water, and joints in vertical runs of pipe are required to have the upper section of jacket overlap the lower section.
- Where aluminum jacketing is used over fiberglass, the joints are required to overlap.
- Aluminum jacketing for equipment is required to have at least 3-in. overlap.
- All openings through the jacketed finish are required to be flashed or caulked so that they are watertight.

The applicant further stated that insulation jacketing is subject to aging management with the Structures Monitoring Program credited to manage piping and mechanical equipment insulation jacketing, and the Boric Acid Corrosion Program also manages insulation jacketing in areas that contain borated water systems. The staff finds the applicant’s response acceptable because the applicant’s specification for installation of insulation jacketing includes appropriate requirements to prevent moisture intrusion or wetting of enclosed calcium silicate or fiberglass insulation, and the applicant’s Structures Monitoring and Boric Acid Corrosion Programs include visual inspections that are capable of detecting degradation of the protective insulation jacketing including the overlapping joints. The staff’s concern described in RAI 3.5.2.3.13-1 is resolved.

The staff reviewed the associated items in the LRA and the applicant’s response to RAI 3.5.2.3.13-1 and confirmed that no credible aging effects are applicable for this component, material, and environmental combination based on industry operating experience related to calcium silicate and fiberglass insulation which, as long as it remains dry, will maintain its CLB function and not impact the component to which it is applied.

3.5.2.3.14 Containment Access Facility and Personnel Shop Facility (including Elevated Walkway)—Aging Management Review Results—LRA Table 3.5.2-14

The staff's evaluation for concrete exposed to an air-indoor environment, for which the applicant cited generic note I and stated there was no aging effect but credited the Structures Monitoring Program for verifying the lack of aging, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant 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 remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical and Instrumentation and Controls

This section documents the staff's review of the applicant's AMR results for the electrical and instrumentation and control (I&C) components and commodity groups of the following components:

- non-environmentally qualified insulated cables and connections
- switchyard bus and connections
- transmission conductors and connections
- high-voltage insulators

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical and I&C components and commodity groups. LRA Table 3.6.1, "Summary of Aging Management Programs for Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the electrical components, I&C components, and commodity groups.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine if the applicant 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 remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff reviewed AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL

Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMPs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's AMR evaluation are documented in SER Section 3.6.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.6.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.6.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.6.2.3.

Table 3.6-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.6 and addressed in the GALL Report.

Table 3.6-1. Staff evaluation for electrical and I&C in the GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Electrical equipment subject to 10 CFR 50.49 EQ requirements (3.6.1-1)	Degradation due to various aging mechanisms	EQ of Electric Components	Yes	TLAA	Consistent with GALL Report (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
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 Used In Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements	Consistent with GALL Report

Component group (GALL Report Item No.)	Aging effect/ mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, supplements, or amendments	Staff evaluation
Conductor insulation for inaccessible medium-voltage (2 kV–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-Voltag e Cables Not Subject to 10 CFR 50.49 EQ Requirements	Consistent with GALL Report
Connector contacts for electrical connectors exposed to borated water leakage (3.6.1-5)	Corrosion of connector contact surfaces due to intrusion of borated water	Boric Acid Corrosion	No	Boric Acid Corrosion	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	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.1.1)
MEB—Bus, connections (3.6.1-7)	Loosening of bolted connections due to thermal cycling and ohmic heating	MEB	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.1.1)
MEB—Insulation, insulators (3.6.1-8)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	MEB	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.1.1)
MEB—Enclosure assemblies (3.6.1-9)	Loss of material due to general corrosion	Structures Monitoring Program	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.1.1)

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
MEB—Enclosure assemblies (3.6.1-10)	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	No	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.1.1)
High-voltage insulators (3.6.1-11)	Degradation of insulation quality due to presence of any salt deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific AMP is to be evaluated	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.2.2)
Transmission conductors and connections; switchyard bus and connections (3.6.1-12)	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	A plant-specific AMP is to be evaluated	Yes	Not applicable	Not applicable to Davis-Besse (see SER Section 3.6.2.2.3)
Cable connections—Metallic parts (3.6.1-13)	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements	Consistent with GALL Report
Fuse holders (Not Part of a Larger Assembly)—Insulation material (3.6.1-14)	None	None	Not applicable	None	Consistent with GALL Report

The staff's review of the electrical and I&C component groups followed any one of several approaches. One approach, documented in SER Section 3.6.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.6.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.6.2.3, reviewed AMR results for components that the applicant indicated are not consistent with or not addressed in the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the electrical and I&C components is documented in SER Section 3.0.3.

3.6.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.6.2.1 identifies the materials, environments, and AERMs, 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 EQ Requirements Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits Program
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program
- Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements Inspection
- Boric Acid Corrosion Program (for the metallic cable connections exposed to air with borated water leakage)

In LRA Table 3.6.2-1, the applicant summarizes AMRs for the electrical and I&Cs components and claimed 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 report and for which the GALL Report does not recommend further evaluation, the staff's review determined if the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR item how the information in the tables aligns with the information in the GALL Report. The staff reviewed those AMRs with notes A–E, indicating how the AMR is consistent 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, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMP.

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent. Therefore, the staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.6.1, item 3.6.1-6, under fuse holders (not part of a larger assembly) metallic clamp, the applicant states that fuse holders are either part of an active assembly or are located in circuits that perform no license renewal intended functions. Therefore, the applicant concluded that fuse holders with metallic clamps at Davis-Besse are not subject to an AMR. During the onsite audit, the staff reviewed the electrical distribution drawings and questioned the applicant if a particular fuse holder was part of an active assembly. The applicant indicated to the staff that this particular fuse holder is part of switchgear (active assembly), which required no AMR. During a plant walkdown, the staff confirmed that this fuse holder is installed in switchgear. Therefore, the staff agreed with the applicant's determination that fuse holders are either part of an active assembly or are located in circuits that perform no license renewal intended function. Therefore, no AMR is required for fuse holders at Davis-Besse.

In LRA Table 3.6.1, items 3.6.1-7, 3.6.1-8, 3.6.1-9, and 3.6.1-10, under the Metal-Enclosed Bus (MEB) component, the applicant stated that aging effects/aging mechanisms for this component are not applicable to Davis-Besse because there is no MEB within the scope of the license renewal evaluation boundary at Davis-Besse. During a plant walkdown, the staff reviewed the SBO recovery paths and confirmed that there is no MEB within the scope of license renewal. Instead, cable buses are used to connect bus tie transformers and the 4,160 V essential switchgear buses for SBO recovery paths. Therefore, the staff finds the applicant's determination that there are no aging effects/aging mechanisms for MEBs at Davis-Besse to be acceptable. The applicant indicated to the staff during the walkdown that these cable buses were not subject to an AMP because they are not located in an adverse localized environment. The staff finds the applicant's determination, that these cable buses are not required to have an AMP, to be acceptable because GALL Report Section VI does not recommend aging management for cable in air-indoor or outdoor environment. However, the cable buses are protected by metal enclosure assemblies and metal material in an air-outdoor environment could be subject to loss of material due to pitting and crevice corrosion. Therefore, in a letter dated April 5, 2011, the staff issued RAI 3.6-1 requesting the applicant to explain how the cable bus enclosure assemblies (including support structures) will be managed during the period of extended operation. In its response dated May 5, 2011, the applicant stated that, per the Davis-Besse 4,160 V cable bus specification, the 4,160 V essential switchgear cable bus enclosure material is aluminum. The applicant confirmed the material type of aluminum by independent walkdown on May 1, 2011. The applicant also stated that, as shown in its LRA, Table 3.5.2-13, "Aging Management Review Results—Bulk Commodities," row 50, "Electrical Cable Bus Ducts," aging effects for the cable bus enclosure assemblies, which include associated support structures, will be managed by the Structures Monitoring Program. The staff finds the applicant's response acceptable because the applicant will manage the cable bus enclosure by the Structures Monitoring Program to prevent loss of material during the period of extended operation. The staff's concern described in RAI B.3.6-1 is resolved.

In LRA Table 3.6-1, item 3.6.1-10, "Metal Enclosed Bus-Enclosure Assemblies," the applicant stated that hardening and loss of strength due to elastomer degradation is not applicable to Davis-Besse because there is no MEB within the scope of license renewal. It is unclear to the staff whether or not the cable bus enclosure assemblies contain elastomers and, if so, how they will be managed for hardening and loss of strength. In a letter dated April 5, 2011, the staff issued RAI 3.6-4, requesting the applicant to explain whether or not the cable bus enclosure assemblies have elastomer components. If the enclosure assemblies have elastomer components, the staff asked the applicant to explain how aging of the components will be properly managed during the period of extended operation. In its response dated June 3, 2011, the applicant stated that the cable bus enclosure assemblies does not have elastomer components. The staff finds the applicant's response acceptable because there are no elastomers in the enclosure assemblies. The staff's concern described in RAI 3.6-4 is resolved.

The staff concludes that the applicant demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.6.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the electrical and I&C components and provided information concerning how it will manage the following aging effects:

- electrical equipment subject to EQ
- degradation of insulator quality due to salt deposits or 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 preload
- 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 corresponding AMR items 3.6.1-11 and 3.6.1-12 in LRA Table 3.6.1. 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

In LRA Section 3.6.2.2.1, the applicant provides an evaluation of the EQ TLAA. SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Presence of Any Salt Deposits and Surface Contamination and Loss of Material Due to Mechanical Wear

LRA Section 3.6.2.2.2, associated with LRA Table 3.6.1, item 3.6.1-11, addresses degradation of insulator quality due to presence of salt deposit and surface contamination, and loss of material due to mechanical wear. The applicant stated that the high-voltage insulators evaluated for license renewal at Davis-Besse include those used to support and insulate high-voltage electrical components (i.e., transmission conductors and connections and switchyard bus). The in-scope power pathway involves the transmission conductors and connections associated with startup transformers 01 and 02 and the in-scope transmission conductors and connections located in the 345-kV switchyard adjacent to the plant. The applicant also stated that various airborne contaminants, such as dust and industrial effluents, can contaminate the insulator surfaces. The rural location of Davis-Besse on the shore of Lake Erie provides for minimal contamination from industrial effluents, and the city of Toledo is more than 20 mi away. The regular rainfall at the site is sufficient to wash any contamination from the insulators. The applicant further stated that there have been no incidents of insulator contamination causing flashover or other insulator failures at Davis-Besse.

The applicant stated that loss of material due to mechanical wear is an aging effect for certain strain insulators, if they are subject to significant movement. Such movement of the insulators can be caused by wind blowing the supported transmission conductor, causing it to sway from side to side. The applicant also stated that if this swinging motion occurs frequently enough, it could cause wear on the metallic contact points of the insulator string and between an insulator and the supporting hardware. Although this aging mechanism is possible, the applicant stated that industry experience has shown that transmission conductors do not normally swing unless subjected to a substantial wind, and they stop swinging shortly after the wind subsides. Wind loading that can result in conductor sway is considered in the transmission system design. In addition, the applicant stated that the sections of transmission conductor that are within the license renewal evaluation boundary at Davis-Besse are relatively short (from startup transformers 01 and 02 into the plant switchyard in lengths of about 200 ft, and then in increments of about 70 ft within the switchyard itself). Therefore, the applicant concluded that loss of material due to mechanical wear is not an AERM for the high-voltage insulators at Davis-Besse.

The staff reviewed LRA Section 3.6.2.2.2 against SRP-LR Section 3.6.2.2.2, which states that degradation of insulator quality due to salt deposits or surface contamination may occur in high-voltage insulators. The GALL Report recommends further evaluation of plant-specific AMPs for plants at locations of potential salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind on transmission conductors may occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff notes that EPRI 1003057 (License Renewal Handbook) states that various airborne materials—such as dust, salt, and industrial effluents—can contaminate insulator surfaces. However, the buildup of surface contamination is gradual, and, in most areas, such contamination is washed away by rain; the glazed insulator surface aids this contamination removal. Surface contamination can be a problem in areas where the concentration of airborne particles is high, such as near facilities that discharge soot or near the sea coast where salt spray is prevalent.

The staff determined that since Davis-Besse 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 insulator contamination causing flashover, degradation of insulator due to salt deposit or surface contamination is not an applicable AERM for high-voltage insulators at Davis-Besse.

In LRA Section 3.6.2.2.2, the applicant stated that industry experience has shown that transmission conductors do not normally swing unless subjected to a substantial wind, and they stop swinging shortly after the wind subsides. The applicant further stated that wind loading that can result in conductor sway is considered in the transmission system design. The applicant then concluded that loss of material due to mechanical wear is not an AERM for the high-voltage insulators at Davis-Besse. However, the applicant did not address plant-specific operating experience with high-voltage insulator and transmission conductor loss of material due to wear. By letter dated April 5, 2011, the staff issued RAI 3.6-2 requesting the applicant to provide a review of plant-specific operating experience concerning aging (i.e., loss of material due to mechanical wear) in high-voltage insulators and transmission conductors at Davis-Besse. In its response dated May 5, 2011, the applicant stated that it conducted a review of the Davis-Besse plant-specific operating experience for license renewal. The results of this review did not identify any instances of wear in high-voltage insulators and transmission conductors installed at Davis-Besse. The staff finds the applicant response acceptable because the applicant reviewed its documented plant-specific operating experience and confirmed that there have been no instances of wear in high-voltage insulators and transmission conductors at Davis-Besse. The staff's concern described in RAI 3.6-2 is resolved.

Based on the programs identified above, the staff concludes that the applicant met the SRP-LR Section 3.6.2.2.2 criteria. For those AMR items that apply to LRA Section 3.6.2.2.2, the staff determined that that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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, associated with LRA Table 3.6.1, item 3.6.1-12, addresses 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 of transmission conductors and connections, and switchyard bus and connections. The applicant stated that, at Davis-Besse, there are relatively short lengths of switchyard bus within the scope of license renewal located in the plant switchyard. This bus is fabricated of 4-in. and 5-in. aluminum tube. The switchyard bus is connected to flexible connections that do not normally vibrate and are supported by insulators and, ultimately, by static structural components such as concrete footings and structural steel. The applicant also stated that the aluminum bus will form a thin surface layer of oxidation, but the conductor properties are not degraded by this thin surface oxidation layer. The applicant stated that galvanized and aluminum bolted connections are exposed to the same service conditions (in the plant switchyard) and do not experience any aging effects, except for minor oxidation of the exterior surfaces, which does not impact their ability to perform their intended function. For the transmission conductors and connections and the switchyard bus and connections, subject to an AMR, the applicant stated that there are no AERMs identified.

The applicant further stated that wind-induced abrasion and fatigue are not aging effects applicable to the in-scope transmission conductors. The applicant stated that industry experience has shown that transmission conductors do not normally swing unless subjected to substantial winds, and they stop swinging after a short period once the wind subsides. Because the transmission conductors are not normally moving, the loss of material due to wind-induced abrasion and fatigue is not an AERM. In addition, wind loading that can result in conductor sway is considered in the transmission system design.

The applicant stated that loss of conductor strength due to corrosion of the transmission conductor is not identified as an aging effect due to a minimal corrosion process at Davis-Besse. The transmission conductor at Davis-Besse is aluminum core alloy reinforced (ACAR). Aluminum is more corrosion-resistant than steel. The applicant also stated that aluminum quickly forms an oxide layer, which protects the material underneath. Aluminum is lighter than steel and provides a much higher strength-to-weight ratio. The applicant further stated that ACAR conductor, therefore, is more resistant to corrosion and to loss of conductor strength than the aluminum core steel reinforced (ACSR) conductor. The applicant stated that the Davis-Besse transmission conductors for the 345-kV offsite power recovery path are 1,024.5 thousand circular mils (MCM) ACAR, Type T-2614, Bare Cable, 24/13 (13 aluminum-alloyed conductors wrapped by a 24-strand aluminum wire) overhead transmission conductors. The applicant also stated that the bolted connections of the transmission conductors are associated with the field connections of transmission conductor to high-voltage insulators and to switchyard bus. The bolting hardware is chosen to be compatible with the transmission conductor. The applicant further stated that stainless steel Belleville washers are specified for use with the transmission conductors, and these methods of assembly are consistent with EPRI 1003471, "Electrical Connector Application Guidelines."

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3, which states that loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff noted switchyard buses at Davis-Besse are connected to flexible conductors that do not swing and are supported by insulators and structural supports such as concrete footings and structural steel. Since there are no connections to moving or vibrating equipment, wind-induced abrasion and fatigue is not an applicable aging mechanism for switchyard bus and connections.

The staff also noted that EPRI 1003057 (License Renewal Handbook) states that transmission conductor vibration could be caused by wind loading. If this swing is frequent enough, it could cause wear in transmission conductors. Although this mechanism is possible, when swinging occurs due to a substantial wind, the swinging does not continue very long once the wind has subsided. Wind loading that can cause a transmission line to vibrate or sway is considered in the design and installation. In addition, the applicant stated (and the staff confirmed through the search of plant-specific operating experience during the onsite audit) that wear has not occurred in transmission conductors at Davis-Besse. Furthermore, transmission conductors within the scope of license renewal are short spans (connecting the switchyard to the startup transformer), and the surface area exposed to wind loads is not significant. Based on its review, the staff finds that mechanical wear of transmission conductors is not an AERM at Davis-Besse.

The staff noted that design of switchyard bolted connections precludes torque relaxation. The use of stainless steel Belleville washers is the industry standard to preclude torque relaxation. Davis-Besse design incorporates the use of stainless steel Belleville washers on bolted electrical connections of dissimilar metals to compensate for temperature changes, maintain the proper torque, and prevent loosening. This method of assembly is consistent with the good bolting practices recommended by industry guidelines (EPRI TR-104213, "Bolted Joint Maintenance & Application Guide").

The applicant stated that galvanized and aluminum bolted connections are exposed to the same service conditions in the plant switchyard and do not experience any aging effects, except for minor oxidation of the exterior surfaces, which does not impact their ability to perform their intended function. The staff noted that aluminum and galvanized connections do not make a good contact surface since pure aluminum and galvanized steel exposed to air form oxides on their surfaces, which are nonconductive and could increase the resistance of connections. SRP-LR Section 3.6.2.2.3 states that increased resistance of connection due to oxidation in transmission conductor and connections and in switchyard bus and connections could occur. The SRP-LR recommends a plant-specific program for management of increase resistance due to oxidation for transmission conductors and switchyard bus connections. By letter dated April 5, 2011, the staff issued RAI 3.6-3 requesting the applicant to explain why increased resistance of connections (galvanized and aluminum bolted connections) is not an AERM. In its response dated May 5, 2011, the applicant stated that LRA Section B.2.11, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection," is revised to enhance the program to include high-voltage connections to confirm the absence of aging effects for the metallic electrical connections. The applicant also stated that LRA Appendix A, "Updated Safety Analysis Report Supplement," Table A-1, "Davis-Besse License Renewal Commitments," is revised to include the B.2.11 program enhancement as a new license renewal future commitment. The staff finds the applicant's response acceptable because the applicant committed (Commitment No. 5) to enhance AMP B.2.11 to include high-voltage connections in the Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Inspection Program. This staff's concern described in RAI 3.6-3 is resolved.

The staff noted that the transmission conductors at Davis-Besse are ACAR. The ACAR conductor is more resistant to corrosion and loss of conductor strength than the ACSR conductors. GALL Report, Revision 2, item VI.A.LP-46, states there is no loss of conductor strength due to corrosion for ACAR exposed to air-outdoor environments and that no AMP is recommended for this component group in the air outside environment. Therefore, the staff determined that loss of conductor strength due to corrosion is not an AERM for ACAR transmission conductors at Davis-Besse.

Based on the programs identified above, the staff concludes that the applicant met the SRP-LR Section 3.6.2.2.3 criteria. For those AMR items that apply to LRA Section 3.6.2.2.3, the staff determined that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA Program.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Table 3.6.2-1, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Table 3.6.2-1, the applicant indicated, via notes F–J, that the combination of component type, material, environment, and AERM does not correspond to an AMR item in the GALL Report. The applicant provided further information about how it will manage the aging effects.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine if the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following section.

3.6.2.3.1 Electrical and Instrumentation and Control Systems—Electrical Component Commodity Groups—Aging Management Review Results—LRA Table 3.6.2-1

LRA Table 3.6.2-1, row numbers 8, 9, 10, and 11 are associated with Table 3.6.1 items 3.6.1-11 and 3.6.1-12. The applicant indicated through note I that the aging effects for the components associated with items 3.6.1-11 and 3.6.1-12 are not applicable and no aging management is required. The staff evaluation of items 3.6.1-11 and 3.6.1-12 is documented in SER Sections 3.6.2.2.2 and 3.6.2.2.3, respectively.

3.6.3 Conclusion

The staff concludes that the applicant 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 remain 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 demonstrated that the aging effects will be adequately managed so that the intended functions will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable USAR supplement program summaries and concludes that the USAR 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 NRC 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 4.2–4.7 of the license renewal application (LRA), FirstEnergy Nuclear Operating Company (FENOC or the applicant) addressed the TLAAs for Davis-Besse Nuclear Power Station, Unit 1 (Davis-Besse). SER Sections 4.2–4.7 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 in accordance with 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

LRA Section 4.1.1 gives the basis for identifying those analyses that need to be evaluated as TLAAs in accordance with 10 CFR 54.21(c)(1). The applicant stated that, for the purpose of meeting this requirement, it evaluated those calculations that met the six criteria for defining an analysis as a TLAA, as specified in 10 CFR 54.3. The applicant stated that its review of the current licensing basis (CLB) included the following documents:

- updated safety analysis report (USAR)
- fire hazards analysis report (incorporated by reference in the USAR)
- Quality Assurance (QA) Program
- Inservice Inspection (ISI) Program
- Inservice Testing Program
- operating license (including technical specifications (TSs))
- exemptions and inspection relief requests
- docketed licensing correspondence
- design calculations and reports (incorporated in the CLB, (e.g., by reference))

In LRA Table 4.1-1, "Time-Limited Aging Analyses," the applicant listed the following TLAA categories:

- reactor vessel (RV) neutron embrittlement
- metal fatigue
- environmental qualification (EQ) of electrical equipment
- concrete containment tendon prestress
- containment fatigue

- other plant-specific TLAAs

LRA Section 4.1.2 provides the applicant's basis for identifying those plant-specific exemptions based on TLAAs, in accordance with 10 CFR 54.21(c)(2). Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it did not identify any exemptions granted as required 10 CFR 50.12 and in effect, or related to 10 CFR Part 50 Appendix R.

4.1.2 Staff Evaluation

LRA Section 4.1.1 documents the applicant's methodology for identifying applicable TLAAs, and LRA Table 4.1-1 provides a list of the TLAAs that are applicable. The staff reviewed the information to determine if the applicant provided sufficient information, pursuant to 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs meet the following six criteria:

(1) involve systems, structures, and components (SSCs) within the period of extended operation, 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 SSC to perform its intended functions, pursuant to 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

The applicant reviewed the 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 Davis-Besse in LRA Table 4.1-2, "Review of Generic TLAAs listed in NUREG-1800," and indicated whether the TLAA was applicable to Davis-Besse or not.

The staff noted that the applicant's list of potential TLAAs was assembled using the following regulatory and industry documents and experience:

- NUREG-1800
- Nuclear Energy Institute (NEI) 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR 54—The License Renewal Rule," Revision 6
- Electric Power Research Institute (EPRI) Report TR-105090, "Guidelines to Implement the License Renewal Technical Requirements of 10 CFR 54 for Integrated Plant Assessments and Time-Limited Aging Analyses"
- LRAs for Babcock and Wilcox (B&W) pressurized-water reactor (PWR) designs, other PWR designs that use B&W RVs, and the associated SERs
- recent LRAs for PWRs

The staff finds the applicant's use of these documents to compile a list of potential TLAAs reasonable because the applicant has used available resources from the NRC, NEI, and past LRAs.

Using the documents listed above, the applicant performed a review of its CLB to determine if the design or analysis feature of each potential TLAA, in fact, exists at Davis-Besse; to ascertain if the feature is included in its licensing basis; and to identify additional potential plant-specific TLAAs. In accordance with 10 CFR 54.21(c), the potential TLAAs that meet all six criteria of a TLAA, as defined in 10 CFR 54.3(a), are actual TLAAs and require a disposition. The applicant reviewed the six criteria based on information in the CLB source documents (as listed above).

The staff finds the applicant's approach for determining TLAAs reasonable because the applicant performed a comprehensive search through its CLB, based on available staff and industry guidance and experience, and reviewed the potential TLAAs against the six criteria of a TLAA, as defined in 10 CFR 54.3(a).

The staff confirmed that the applicant's LRA includes the TLAAs that are normally applicable to PWR applications, including the following TLAAs:

- RV neutron embrittlement: upper-shelf energy (USE), pressurized thermal shock (PTS) limits, and pressure-temperature (P-T) limits (neutron fluence is discussed in the LRA as it applies to RV neutron embrittlement TLAAs but it is identified as "not a TLAA")
- metal fatigue of American Society of Mechanical Engineers (ASME) Code Class 1 components and non-Class 1 components, including effects of reactor water environment on fatigue
- EQ of electrical equipment
- fatigue of the reactor containment vessel

The staff finds the applicant's identification of these TLAAs acceptable because they are consistent with the TLAAs identified in SRP-LR Sections 4.2, 4.3, 4.4, and 4.6 as being applicable to PWR LRAs.

The staff also confirmed that the LRA included the following additional plant-specific TLAAs:

- leak-before-break (LBB)
- metal corrosion allowance for pressurizer instrument nozzles
- RV thermal shock due to borated water storage tank (BWST) water injection
- high-pressure injection (HPI) and makeup nozzle thermal sleeves
- ISI-fracture mechanics analyses (reactor coolant system Loop 1 cold leg drain line weld overlay repair, once-through steam generator (OTSG) 1-2 flaw evaluations)
- ASME Code Case N-481 evaluation (added by LRA Amendment 13 on August 17, 2011)
- crane load cycles (added by LRA Amendment 19 on October 7, 2011)

The staff confirmed that the applicant's identification of these additional TLAAs satisfies the recommendation in SRP-LR Section 4.7, which states that the applicant identify any additional analyses for the facilities that meet the definition of a TLAA, in accordance with the requirements of 10 CFR 54.3. The staff did not identify any omissions of TLAAs for this LRA.

Based on its review, the staff concludes that the applicant satisfied the requirements of 10 CFR 54.3 to identify the TLAAs that are applicable to the LRA because the applicant satisfied the TLAA identification guidance and recommendations in SRP-LR Sections 4.2 through 4.7.

The staff confirmed that the TLAAs identified by the applicant as being applicable to the LRA have been evaluated by the applicant against the provisions and criteria of 10 CFR 54.21(c)(1). The staff's evaluations of these TLAAs are summarized in SER Sections 4.2 through 4.7.

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted in accordance with 10 CFR 50.12, based on TLAAs, and evaluate and justify continuation through the period of extended operation. The LRA states that each active exemption was reviewed to determine if it was based on a TLAA. The applicant did not identify any TLAA-based exemptions applicable to the period of extended operation. Based on the information provided by the applicant regarding the process used to identify these exemptions and its results, the staff concludes, in accordance with 10 CFR 54.21(c)(2), that there are no TLAA-based exemptions justified for continuation through period of extended operation.

4.1.2.1 Evaluation of the Applicant's Identification of Time-Limited Aging Analyses

The staff's Statement of Considerations (SOC) on 10 CFR Part 54, as given in *Federal Register* Notice, Volume 60, Number 88, Section III.g.(i), (FRN Volume 60, No. 88, dated May 8, 1995), clarifies when an analysis in the CLB needs to be identified as a TLAA in accordance with the rule. SRP-LR Section 4.1 provides additional guidance as to when an analysis in the CLB needs to be identified as a TLAA in accordance with 10 CFR 54.3.

For each of the TLAAs identified in LRA Table 4.1-1, the staff evaluated the applicant's basis for disposition of these TLAAs, in accordance with 10 CFR 54.21(c)(1)(i), 10 CFR 54.21(c)(1)(ii), or 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's disposition are documented in SER Sections 4.2, 4.3, 4.4, 4.5, 4.6, and 4.7, and their applicable subsections.

For those analyses in LRA Tables 4.1-1 and 4.1-2 identified as "not TLAAs," the staff reviewed the applicant's basis for its conclusion. Specifically, the staff confirmed that either an existing analysis in the CLB would not need to be identified as a TLAA, or a specific, generic TLAA mentioned in either SRP-LR Table 4.1-2 or Table 4.1-3 was not applicable. If the analysis is addressed in detail in the LRA, such as LRA Section 4.2.1 on Neutron Fluence, then the staff's evaluation is provided in the analogous section of this SER, such as SER Section 4.2.1, "Neutron Fluence." Otherwise, the staff's evaluation is provided in the following subsections.

4.1.2.1.1 Reactor Coolant Pump Flywheel

LRA Table 4.1-2 states that the fatigue analysis of the reactor coolant pump (RCP) flywheels in the SRP-LR is not applicable to the applicant's CLB because it did not identify any applicable time-dependent analysis for the RCP flywheels that conforms to the criteria for a TLAA in 10 CFR 54.3.

The staff noted that SRP-LR Table 4.1-3 identifies the fatigue analysis of RCP flywheels as a potential, plant-specific TLAA. The staff reviewed relevant information in SRP-LR Section 4.1, NUREG-0800 (SRP), SRP Section 5.4.1.1, and the applicant's USAR as the basis for determining if the applicant's basis was valid.

The staff noted that the applicant's bases for ensuring the structural integrity of the RCP flywheel against the consequences of a non-ductile fast fracture or a postulated fracture of the flywheel during a sudden seizure of the RCP flywheel rotor are documented in USAR

Section 5A. The staff reviewed USAR Section 5A, which states that the applicant applies the criteria from SRP Section 5.4.1.1, "Pump Flywheel Integrity," and NRC Safety Guide 14 as the basis for ensuring the integrity of the RCP flywheels during these types of postulated events and the integrity of the RCP casing against the generation of postulated RCP flywheel missiles. The staff noted that this is required to conform to the missile generation protection criteria in 10 CFR Part 50, Appendix A, General Design Criterion 4, "Dynamic Effects." The staff also noted that USAR Section 5A established the applicant's basis for using a value of 40 degrees Fahrenheit (°F) as a conservative estimate of the nil-ductility reference temperature (RT_{NDT}) for the SA-533, Grade B ferritic materials that were used to fabricate the RCP flywheel discs. USAR Section 5A also set a 120 °F operating temperature as the basis for meeting a 150 ksi-in$^{1/2}$ linear-elastic fracture toughness criterion (K_{Ic}), which is used as the basis in SRP Section 5.4.1.1 for protecting against the generation of postulated RCP flywheel missiles.

The staff compared the applicant's basis in USAR Section 5A against the design overspeed criteria (sudden seizure protection criteria) in SRP Section 5.4.1.1, to determine if the sudden seizure basis in USAR Section 5A should be identified as a TLAA. The staff noted that the NRC's bases in SRP Section 5.4.1.1 do not use an analysis as the basis for protecting RCP flywheels against design overspeed (sudden seizure) events. Instead, the SRP section recommends that specific RCP flywheel design overspeed considerations be met as the basis for protecting against RCP flywheel overspeed sudden seizure events. Thus, based on this review, the staff confirmed that the design overspeed basis in USAR Section 5A does not rely on an analysis that has a time dependency; therefore, it does not involve a TLAA for protecting against a design overspeed sudden seizure event.

The staff also reviewed the applicant's basis in USAR Section 5A against the fracture toughness criteria (non-ductile failure criteria) in SRP Section 5.4.1.1, to determine if the non-ductile failure analysis basis in USAR Section 5A would need to be identified as a TLAA. The staff also performed a review of the RCP flywheel design and the reactor coolant system (RCS) operating criteria to determine if the RT_{NDT} value methodology, which is a part of the non-ductile failure basis, would need to include a time-dependent neutron fluence consideration and adjustment.

Specifically, the staff noted that the non-ductile failure analysis referenced in SRP Section 5.4.1.1 recommends that the RCP flywheel materials made from ferritic steel materials meet a minimum allowable fracture toughness (K_{Ic}) of 150 ksi-in$^{1/2}$ to demonstrate that the RCP flywheel rotors and discs will be protected from a postulated non-ductile failure. The staff also noted that Appendix A in the ASME Code Section XI provides an acceptable basis for relating the K_{Ic} fracture toughness property for a ferritic material (i.e., SA-533, Grade B Class ferritic plate materials, or SA-508, Class 2 or 3 ferritic forging materials) to the operating temperature of a component that is made from one of these materials. The staff noted that ASME Code Appendix A permits users applying the appendix to use Figure A-4200-1 in the appendix or, alternatively, the following equation, to establish this K_{Ic}-operating temperature relationship:

$$K_{Ic} = 33.2+20.734*\exp[0.02*(T–RT_{NDT})]$$

From this equation, the K_{Ic} for SA-533, Grade B steel will be maintained above the acceptance criterion of 150 ksi-in$^{1/2}$ if $T–RT_{NDT}$ is greater than or equal to 80 °F. The staff noted that the applicant's licensing basis of 40 °F for RT_{NDT} and minimum 120 °F flywheel operating temperature would indicate that the 150 ksi-in$^{1/2}$ K_{Ic} criterion in SRP Section 5.4.1.1 is met.

The RCP flywheels are not exposed to an operating environment that could cause time-dependent changes in the fracture toughness, such as exposure to a high-energy neutron environment (i.e., neutrons with energies in excess of 1.0 MeV). Therefore, the non-ductile failure analysis of RCP flywheels in USAR Appendix 5A does not need to be identified as a TLAA because it does not include a time-dependent assumption defined by the life of the plant, and thus does not conform to Criterion 3 of 10 CFR 54.3(a).

Therefore, the staff finds acceptable the applicant's conclusion that there are no TLAAs associated with the RCP flywheels.

4.1.2.1.2 Inservice Local Metal Containment Corrosion Analysis

LRA Tables 4.1-1 and 4.1-2 state that the CLB does not include any inservice local metal containment corrosion analyses which conform to the definition of a TLAA in 10 CFR 54.3, that need to be identified as a TLAA in accordance with the TLAA identification requirement in 10 CFR 54.21.

The staff reviewed the Davis-Besse USAR for relevant information. The staff confirmed that the USAR does not make any reference to a corrosion analysis for the steel containment vessel. Based on this review, the staff finds that the applicant provided an acceptable basis for concluding that the generic inservice local metal containment corrosion allowance TLAA, mentioned in SRP-LR Table 4.1-2, does not need to be applied as a TLAA for the LRA because the CLB does use this type of analysis to justify management of corrosion in the applicant's steel containment vessel. Instead, the staff confirmed that the applicant uses its ISI Program—IWE as the basis for managing loss of material due to corrosion in the steel containment vessel. The staff's evaluation of the applicant's ISI Program—IWE is documented in SER Section 3.0.3.1.10.

4.1.2.2 Evaluation of the Applicant's Identification of those Exemptions in the CLB that are Based on TLAA-s

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted pursuant to 10 CFR 50.12, which are based on TLAAs, and evaluate them for continuation through the period of extended operation. LRA Section 4.1.2 states that the USAR, fire hazards analysis report, operating license (including TSs), initial Davis-Besse SER, and docketed licensing correspondence were searched to identify exemptions that were granted pursuant to 10 CFR 50.12, as well as those related to 10 CFR Part 50, Appendix R. From this document review, the applicant determined that there are no exemptions identified as being granted pursuant to 10 CFR 50.12 and based on a TLAA.

The staff reviewed the LRA and applicant's documents in the CLB to verify whether there were any exemptions granted in accordance with 10 CFR 50.12 and based on a TLAA. The staff's search included those exemptions that may have been requested pursuant to 10 CFR 50.60(b) to deviate from the requirements for applicable USE or P-T limit assessments in 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," and that may have been approved under the exemption acceptance provisions of 10 CFR 50.12.

The staff noted that the applicant's CLB includes approved exemptions from complying with the applicable 10 CFR 50.46 and 10 CFR Part 50, Appendix K, requirements for operability of emergency core cooling systems and with 10 CFR Part 50, Appendix R, requirements for ensuring adequate fire protection. The staff noted that these exemptions were not based on a time-dependent analysis that involved an assessment of either a detected or postulated aging effect. Therefore, based on its review, the staff finds these exemptions did not need to be identified as exemptions that were based on a TLAA, in accordance with 10 CFR 54.21(c)(2).

The staff noted that the applicant's CLB included an exemption request, in accordance with 10 CFR 50.60(b), related to the proposed use of an alternative methodology in Areva Report BAW-2308-A to deviate from the applicable requirements for generation of P-T limits in 10 CFR Part 50, Appendix G, and from the PTS analysis requirements in 10 CFR 50.61. The NRC approved this exemption to use the alternative methods in Report No. BAW-2380-A in a safety evaluation (SE) dated December 14, 2010. The staff noted that this exemption relates to the use of the following alternative technologies:

- alternative technology for establishing the initial RT_{NDT} values for the Linde 80 weld materials using the master curve test data and technology, as related to generation of the adjusted reference temperatures used in the P-T limit and PTS analyses
- use of ASME Code Case N-588 to establish alternative primary stress intensity factors for RV beltline material circumferential welds, as used in the generation of the applicant's 10 CFR Part 50, Appendix G, P-T limit curves for the facility
- use of ASME Code Case N-640 as the basis using a K_{Ic} stress intensity factor acceptance criterion (in lieu of using the K_{Ia} stress intensity factor acceptance criterion that would be required by Appendix G of the ASME Code), as used in the generation of the applicant's 10 CFR Part 50, Appendix G, P-T limit curves for the facility

The staff noted that, although this exemption relates to the applicant's P-T limit and PTS TLAAs, it is not based on a time-dependent analysis that needs to be identified as a TLAA. The staff confirmed that this exemption, to apply the alternative methods in BAW-2380-A, is based on the analysis of alternative master curve surveillance program data and the use of alternative stress intensity factor criteria in ASME Codes N-588 and N-640, which do not involve a time-dependent analysis. The staff noted that Regulatory Issue Summary (RIS) 2004-04 permits applicants to use the methods of analysis in NRC-approved ASME Code Cases N-588, N-640, or N-641 for the development of their plant's P-T limit curves without the need for a regulatory exemption on the licensing basis. Thus, the staff determined that the exemption and alternative methodologies in Report BAW-2380-A do not need to be identified as an exemption for the LRA because they are not based on a TLAA.

Based on its review, the staff finds that the applicant provided an acceptable basis for concluding that the LRA does not need to list any exemptions, in accordance with exemption identification requirements in 10 CFR 54.21(c)(2). The staff confirmed that those exemptions, which were previously granted under the provisions of 10 CFR 50.12, were not based on a TLAA.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff confirmed, as required by 10 CFR 54.21(c)(2), that no exemptions exist in the CLB that have been granted under the requirements in 10 CFR 50.12 and that were based on a TLAA.

4.2 Reactor Vessel Neutron Embrittlement

During plant service, neutron irradiation reduces the fracture toughness of ferritic steel in the beltline region of the RV (as defined in 10 CFR Part 50, Appendix G) and stainless steel reactor vessel internals (RVI) for light-water nuclear power reactors. Areas of review to ensure that the ferritic RV beltline materials and stainless steel RVI have adequate fracture resistance during both normal and off-normal operating conditions (e.g., upset, emergency, and faulted conditions) include the following:

- RV neutron fluence
- RV materials' USE reduction due to neutron embrittlement
- RV materials' resistance to PTS
- adjusted RT_{NDT} for RV materials due to neutron embrittlement
- operating P-T limits for heatup and cooldown (HU/CD) operations, as well as hydrostatic and leak-testing conditions
- RCS low-temperature overpressure protection (LTOP) system limits for protection of the RV against brittle fracture
- protection of stainless-steel-clad SA-508, Class 2 RV forgings against underclad cracking
- reduction in fracture toughness for RVI

Appendix G of 10 CFR Part 50 specifies fracture toughness requirements for ferritic pressure-retaining components that make up the reactor coolant pressure boundary (RCPB) of light water nuclear reactors. This rule states that RV beltline material properties, including the RT_{NDT} values and Charpy USE values, must account for the effects of neutron radiation. The adjusted RT_{NDT} (ART) value is defined as the sum of the initial RT_{NDT} value for the material in the unirradiated condition, the shift in the RT_{NDT} value caused by irradiation (ΔRT_{NDT}), and a margin term (M). The ART value forms the basis for determining the P-T limits. ΔRT_{NDT} is a function of the material's copper (Cu) and nickel (Ni) content and the neutron fluence to which the material is exposed. ΔRT_{NDT} is calculated as the product of a chemistry factor (CF) and a fluence factor, based on the NRC staff guidelines for radiation embrittlement calculations in Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988. The CF is dependent upon the amount of Cu and Ni in the material and may be determined from tables in RG 1.99, Revision 2, or from surveillance data. The fluence factor is exclusively dependent upon the neutron fluence and may be calculated using the formula specified in RG 1.99, Revision 2. The M term is dependent upon whether the initial RT_{NDT} value is a plant-specific value or a generic value and whether the CF value was determined using the tables in RG 1.99, Revision 2, or surveillance data. The M term accounts for uncertainties in the values of the initial RT_{NDT}, the Cu and Ni contents, the fluence, and the calculation methods. RG 1.99, Revision 2, describes the methodology for calculating the M term.

RG 1.99, Revision 2, also specifies methods for determining the projected percentage decrease in USE as a function of Cu content and neutron fluence, including methods for adjusting the percentage USE decrease using credible USE surveillance data.

10 CFR 50.61, the PTS Rule, provides requirements for ensuring the resistance of RV beltline materials against PTS events, as applicable only to PWR plants. The PTS Rule characterizes the toughness of RV beltline materials by the reference temperature for PTS, RT_{PTS}, which is defined as the RT_{NDT} value evaluated for the projected end-of-license fluence. The PTS Rule requires that RT_{PTS} values be determined for all RV beltline materials using the procedures specified in paragraph C of the rule. Procedures for calculating RT_{PTS} are the same as those used for calculating RT_{NDT}. RT_{PTS} values for all RV beltline materials shall not exceed the

screening criteria specified in 10 CFR 50.61(b)(2), except as provided in 10 CFR 50.61(b)(3)–10 CFR 50.61(b)(7).

The USE, ART, and RT_{PTS} calculations meet the criteria of 10 CFR 54.3(a), and thus they are TLAAs. The TLAAs of the USE, ART, and RT_{PTS} for RV beltline materials are based on projected neutron fluence inputs at specific locations in the RV wall. The USE and ART values are calculated using neutron fluence values at a depth equal to one-quarter of the vessel wall thickness (1/4T). The RT_{PTS} values are calculated using neutron fluence values at the clad-to-base metal interface of the RV wall, as required by 10 CFR 50.61. RG 1.99, Revision 2, quantifies fluence attenuation through the RV wall, based on a known wetted surface fluence, for calculating fluence at various depths from the wetted surface.

4.2.1 Neutron Fluence

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 states that the fast neutron fluence values were conservatively estimated at 52 effective full power years (EFPY) of reactor operation, as given in LRA Table 4.2-1. The applicant stated that these fluence values are based on the original licensed thermal power of 2,772 megawatt thermal (MWt) through 2008 and 100 percent power of 2,817 MWt from 2008 to end-of-life, uprated through a licensed measurement uncertainty recapture (MUR) power uprate. The applicant stated that, based on actual reactor core power histories to date and conservative estimates of future core designs, extended plant operation to 60 years will be bounded by 52 EFPY of facility operation. According to the applicant, reaching 52 EFPY at the end of 60 years would require an average plant capacity factor greater than 98.5 percent from 2008 to the end of the period of extended operation.

LRA Section 4.2.1 states that neutron fluence values were calculated for the Davis-Besse RV for the extended 60-year licensed operating period (52 EFPY) using the fluence methodology of Areva Document BAW-2241P-A, "Fluence and Uncertainty Methodologies," April 1999. The applicant stated that the neutron fluence values were calculated in accordance with RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." According to the applicant, neutron fluence results were calculated for Cycles 13-14 irradiation using a computer model that extends from below the core to the RV mating surface. The applicant also stated that the sum of the end of cycle 12 and Cycles 13-14 neutron fluence results in the end of cycle 14 cumulative neutron fluence, and this data was benchmarked against cavity dosimetry data for Cycles 13-14. To extrapolate the neutron fluence values to the end of life, the applicant indicated that Cycle 15 design information was used to develop flux projections at each location. The applicant stated that these Cycle 15 flux values were used to extrapolate the end of Cycle 14 fluence to 52 EFPY assuming 100 percent power at 2817 MWt and a partial low leakage core design whereby high thermal performance fuel assemblies were introduced on the periphery. A summary of the 52 EFPY fluence values for the RV beltline materials, including forgings and welds, is provided in Table 4.2-1 of the LRA. The fluence values in LRA Table 4.2-1 were calculated at the inside wetted surface of the RV.

LRA Tables 4.2-2 through 4.2.4 provide USE, ART, and RT_{PTS} values for the beltline materials, which includes all ferritic materials with projected neutron fluence exposures greater than 1×10^{17} n/cm^2. The applicant identified that the limiting weld and forging materials (with regard to their embrittlement analyses for 60 years of operation) are WF-182-1 and BCC 241, respectively. These limiting materials are the same as for the case of 40 years operation and are included in the RV Surveillance Program so that no additional materials are required for irradiation and testing.

The LRA states that neutron fluence is not a TLAA, that it "is an assumption used in various neutron embrittlement TLAAs."

4.2.1.2 Staff Evaluation

The staff reviewed LRA Section 4.2.1 on neutron fluence to evaluate the applicant's determination that neutron fluence is not a TLAA in accordance with 10 CFR 54.21(c)(1). The staff also reviewed this section for technical adequacy of the neutron fluence values used by the applicant in its determinations on the TLAAs in LRA Section 4.2.

SRP-LR Section 4.2.3.1 does not identify specific review procedures for a TLAA related to the neutron fluence. However, neutron fluence is a time-dependent parameter used by the applicant for determining RV beltline materials requiring neutron embrittlement analyses in LRA Sections 4.2.2, 4.2.3, and 4.2.4. LRA Section 4.2.1 documents the applicant's determination of RV beltline materials, based on the projected neutron fluence. Since projected neutron fluence is a time-dependent parameter used by the applicant for determining the RV beltline materials subject to neutron embrittlement analysis, neutron fluence is a TLAA. Therefore, the staff stated in a conference call held on February 9, 2012, that its position is that neutron fluence is a TLAA and asked the applicant to explain why it does not consider neutron fluence to be a TLAA. The applicant stated that it agrees with the staff position and that it will revise LRA Section 4.2.1 to identify neutron fluence as a TLAA and select an appropriate disposition for this TLAA as required by 10 CFR 54.21(c)(1).

By letter dated March 9, 2012, the applicant provided LRA Amendment 24 to identify neutron fluence as a TLAA. The applicant dispositioned neutron fluence as a TLAA in accordance with 10 CFR 54.21(c)(1)(ii) based on the fact that RV neutron fluence values have been projected to the end of the period of extended operation and were used in LRA Section 4.2.1 as the basis for determining the RV beltline materials subject to neutron embrittlement evaluation. Therefore, the staff determined that its concern regarding the identification of neutron fluence as a TLAA and the disposition of this TLAA as required by 10 CFR 54.21(c)(1) is resolved.

In accordance with 10 CFR Part 50, Appendix G, and 10 CFR 50.61, ferritic materials for all RV beltline components shall be evaluated for neutron radiation embrittlement for the duration of the facility operating license. The RV beltline region is defined in 10 CFR Part 50, Appendix G, and 10 CFR 50.61 as the region of the RV that surrounds the effective height of the active core and adjacent regions of the RV that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limiting material with respect to neutron radiation damage. A fluence threshold for identifying the RV beltline components is defined in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 2, December 2010, as 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation. This fluence threshold is based on the RV Materials Surveillance Program requirements of 10 CFR Part 50, Appendix H, which requires monitoring the changes in fracture toughness (i.e., neutron embrittlement) parameters for all RV materials projected to experience neutron fluence greater than 10^{17} n/cm^2 (E > 1.0 MeV) at the expiration of the facility operating license. Therefore, if projected high-energy neutron fluence for ferritic RV materials at the clad/base metal interface is greater than a threshold value of 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation, these materials shall be evaluated for neutron embrittlement. LRA Table 4.2-1 lists the 52 EFPY fluence values at the inside wetted surface of the RV. All ferritic

RV materials with fluence values at the inside wetted surface greater than 1 x 10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation are identified in LRA Section 4.2.1 as RV beltline components requiring neutron embrittlement evaluation in accordance with 10 CFR Part 50, Appendix G. The staff noted that fluence values at the inside wetted surface of the RV are slightly greater than those at the clad/base metal interface by a factor of approximately 1.006–1.026 due to neutron fluence attenuation through the approximately 1/8 in. thick stainless steel cladding. Therefore, the staff found that the applicant's identification of RV beltline materials, based on a projected 52 EFPY fluence at the inside wetted surface of the RV, is acceptable.

The staff independently reviewed the 52 EFPY fluence values provided by the applicant in LRA Table 4.2-1 and determined that these fluence values were appropriately calculated using the BAW-2241NP-A fluence methodology. This fluence methodology was previously reviewed and approved by the staff using the generic methodology and the staff's SE authorizing the use of this methodology is provided in an attachment to the BAW-2241NP-A report. The BAW-2241NP-A fluence methodology appropriately follows the guidance of RG 1.190. Although the revision of BAW-2241 cited by the applicant was approved prior to the initial issuance of RG 1.190, the revision had been found adherent to Draft Guide 1053, on which RG 1.190 was based. The applicable guidance in both regulatory documents is effectively the same; therefore, the calculational framework used by the applicant is acceptable. Furthermore, the staff confirmed that the 52 EFPY fluence values account for the effects of the applicant's 2008 measurement uncertainty recapture power uprate. Therefore, the staff finds that the 52 EFPY neutron fluence values provided in LRA Table 4.2-1 are acceptable for use as inputs for the neutron embrittlement TLAAs provided in LRA Sections 4.2.2, 4.2.3, and 4.2.4.

Because the fluence calculation methodology is approved by the staff and adherent to RG 1.190, the staff finds that the calculated fluence values in LRA Table 4.2.1-1 are acceptable for use as inputs for the neutron embrittlement TLAAs provided in LRA Sections 4.2.2, 4.2.3, and 4.2.4.

Based on the revision to LRA Section 4.2.1 provided in LRA Amendment 24, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the RV neutron fluence values and the determination of RV beltline materials subject to neutron embrittlement analysis, have been projected for the period of extended operation and, therefore, are acceptable.

4.2.1.3 USAR Supplement

LRA Section A.2.2.1 as amended (LRA Amendment 24) by letter dated March 9, 2012, provides the USAR supplement for the RV neutron fluence and beltline analysis TLAA evaluation. Based on its review of the USAR supplement, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.2.3.2.

4.2.1.4 Conclusion

On the basis of its review the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for determining the neutron fluence values and the RV beltline materials subject to neutron embrittlement evaluation have been projected to the end of the period of extended operation. 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), and, therefore, is acceptable.

4.2.2 Upper-Shelf Energy

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 describes the applicant's USE TLAA. The applicant used initial (unirradiated) USE values for the Davis-Besse RV beltline forgings from USAR Table 5.2-15. As stated in LRA Section 4.2.2, no initial USE data is available for the beltline welds (Linde 80 submerged-arc welds). Therefore, according to the applicant, weld acceptability for 32 EFPY was justified based on an equivalent margins analysis (EMA) performed using elastic plastic fracture mechanics (EPFM) analysis methods. The applicant stated that, for the Linde 80 welds, 32 EFPY EMAs are documented in topical reports BAW-2192P-A, "Low Upper-Shelf Toughness Fracture Analysis of Reactor Vessels of B&W Owners Group Reactor Vessel Working Group for Load Level A & B Conditions," April 1994, and BAW-2178P-A, "Low Upper-Shelf Toughness Fracture Analysis of Reactor Vessels of B&W Owners Group Reactor Vessel Working Group for Level C & D Service Loads," April 1994.

The applicant stated that a subsequent EMA was performed for the limiting weld, upper shell forging to lower shell forging circumferential Weld WF-182-1, for MUR power uprate conditions. This EMA demonstrated limiting weld acceptability through 32 EFPY.

The applicant stated that USE values are projected to 52 EFPY based on the methods in RG 1.99, Revision 2. The applicant stated that surveillance data was also used for weld WF-182-1 and lower shell forging BCC 241, in accordance with Position 2.2 of the RG. The applicant also stated that all RV beltline locations are projected to maintain USE greater than 50 foot-pound (ft-lb) with the exception of weld WF-182-1. For the RV inlet nozzle forging and attachment weld, the RV outlet nozzle forging and attachment weld, the dutchman forging, and the weld that connects the lower shell forging to the dutchman forging, the applicant stated that the projected USE is conservatively calculated based on a 1/4T fluence of 1.0×10^{18} n/cm^2 (E > 1.0 MeV), which is the lowest fluence for the curves plotted in RG 1.99, Revision 2, Figure 2, for determining projected percent decrease in USE. For all other beltline materials, 52 EFPY USE values are based on fluence values from LRA Table 4.2-1, adjusted for attenuation to a 1/4T depth. The 52 EFPY USE data for all RV beltline materials are presented in LRA Table 4.2-2.

The applicant reported that the limiting RV beltline weld, WF-182-1, is the only beltline material with a projected USE value below 50 ft-lb at 60 years (52 EFPY). The LRA states that the EPFM evaluation (EMA) of Weld WF-182-1 at Davis-Besse was extended from 32 EFPY to 52 EFPY based on the projected 52 EFPY neutron fluence values. The applicant stated that this analysis demonstrates that the limiting RV beltline weld at Davis-Besse satisfies the requirements of the ASME Code, Section XI, Appendix K, analysis for ductile flaw extension and tensile stability using projected USE value for the weld material at 52 EFPY. The LRA states that the 52 EFPY EPFM analysis addresses ASME Code, Section III, Levels A, B, C, and D service loadings and was performed using the procedures and acceptance criteria in Appendix K of the ASME Code, Section XI.

The applicant evaluated the effect of 52 EFPY fluence on the J-integral resistance (J-R) of the material, as determined from the J-R fracture resistance curve. The J-R curve is a plot of J-R versus the postulated crack extension. The applicant stated that the neutron fluence at the postulated crack tip was calculated using the methods in RG 1.99, Revision 2.

The applicant stated that the analytical methodology and the applied loadings for the EMA have not changed. The applicant also noted that the initial RT_{NDT} value for weld WF-182-1 was revised from 2 °F to negative 80.2 °F, and the margin term for this weld was revised from 56 °F to 59 °F. The applicant stated that all other mechanical properties are unchanged. The applicant further stated that the existing transition region fracture toughness curve, which is used to define the beginning of the upper shelf region, is indexed to the initial RT_{NDT} value. The applicant determined that the existing transition region fracture toughness curve evaluation remains conservative for 52 EFPY since the initial RT_{NDT} value decreased.

The applicant determined that the hot leg large break loss-of-coolant accident (LOCA) is the limiting transient at 32 EFPY and 52 EFPY since it most closely approaches the K_{Jc} limit (plane-strain fracture toughness in units of J) of the weld. The applicant stated that, in the USE toughness range, the applied stress intensity factor (K_I) curve is closest to the lower bound K_{Jc} curve at 5.60 minutes into the transient. The applicant also stated that this time would be used as the critical time in the transient at which to perform the flaw evaluation for Levels C and D service loadings.

As a summary of EMA results for Level A, B, C, and D service loadings at 52 EFPY, the applicant provided the following data demonstrating that the ASME Code, Section XI, Appendix K acceptance criteria are satisfied for Levels A and B service loadings:

- With factors of safety of 1.15 on pressure and 1.0 on thermal loading, the applied J-integral (J) at a flaw extension of 0.10 in. (J_1) is less than the J-R curve at a ductile flaw extension of 0.10 in. ($J_{0.1}$). The ratio $J_{0.1}/J_1$ = 3.69 is significantly greater than the minimum required value of 1.0.
- With factors of safety of 1.25 on pressure and 1.0 on thermal loading, flaw extensions are ductile and stable because the derivative (with respect to flaw extension) of the applied J curve is less than the derivative of the lower bound J-R curve, at the point where the two curves intersect.

The applicant provided the following data to demonstrate that the ASME Code, Section XI, Appendix K acceptance criteria are satisfied for Levels C and D service loadings:

- With a factor of safety of 1.0 on loading, the ratio $J_{0.1}/J_1$ = 2.16 is significantly greater than the minimum required value of 1.0.
- With a factor of safety of 1.0 on loading, flaw extensions are ductile and stable because the derivative of the applied J curve is less than the derivatives of both the lower bound and mean J-R curves at the points of intersection.
- Flaw growth is stable at much less than 75 percent of the vessel wall thickness. It was also shown that the remaining ligament is sufficient to preclude tensile instability by a large margin.

The applicant also stated that the limiting beltline weld at Davis-Besse satisfies the requirements of the ASME Code, Section XI, Appendix K, for ductile flaw extension and tensile stability using projected Charpy USE values for the weld material at 32 EFPY and 52 EFPY.

Based on the above, the applicant concluded that the USE values and EMA for the RV beltline materials have been projected to remain acceptable during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.2.2 on USE to confirm, pursuant to 54.21(c)(1)(ii), that the USE and EMA for the RV beltline materials have been projected to the end of the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.2.3.1.1.2, which state that the documented results of the revised USE analysis or EMA based on the projected neutron fluence at the end of the period of extended operation are reviewed for compliance with 10 CFR Part 50, Appendix G. The staff used the applicant's 60-year projected neutron fluence values for the RV beltline materials as the basis for determining either whether the beltline materials would maintain acceptable levels of USE during the period of extended operation or whether the EMA would meet the acceptance criteria for the period of extended operation. The staff reviewed the applicant's 60-year projected USE values against the USE criteria in 10 CFR Part 50, Appendix G, which establish the lower limits on acceptable values of USE. The staff also reviewed the applicant's 60-year projected EMA against the EPFM acceptance criteria of the ASME Code, Section XI, Appendix K.

Section IV.A.1.a of Appendix G to 10 CFR Part 50 states, in part, that RV beltline materials must maintain Charpy USE values in the transverse direction for base metal and along the weld for weld material of no less than 50 ft-lb, throughout the 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 USE will ensure margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code. For RV shell materials with low projected end-of-license USE values or unknown initial USE values, analyses to demonstrate margins of safety against fracture, equivalent to those required by Appendix G of Section XI of the ASME Code can be performed using the ASME Code, Section XI, Appendix K methodology (i.e., EMAs).

In accordance with RG 1.99, Revision 2, the predicted decrease in USE due to neutron embrittlement during plant operation is dependent upon the amount of Cu in the material and the projected neutron fluence for the material. Regulatory Position 1.2 of the RG specifies methods for calculating the predicted percentage decrease in USE for materials that do not have sufficient credible surveillance data. The applicant provided calculations of the projected USE values at 52 EFPY for all RV beltline forgings in LRA Table 4.2-2, based on the initial (unirradiated) USE values for these materials. The staff determined that the applicant correctly used Regulatory Position 1.2 of RG 1.99, Revision 2 (Figure 2 from the RG), for calculating the projected percentage decrease in USE at 52 EFPY for these RV beltline forgings. The staff confirmed that the LRA Table 4.2-2 values for initial USE and Cu content are consistent with those listed in the staff's RV Integrity Database (RVID). The staff found that the applicant correctly determined the projected 52 EFPY USE values for the RV beltline forgings by applying the predicted percentage decrease in USE, as determined using Figure 2 of RG 1.99, Revision 2, to the initial USE values. All of the 52 EFPY USE values for the RV beltline forgings, as listed in LRA Table 4.2-2, are projected to remain greater than the 50 ft-lb minimum USE requirement specified in 10 CFR Part 50, Appendix G. Therefore, the staff determined that the applicant's USE analysis for the RV beltline forgings was acceptable for the period of extended operation.

In LRA Section 4.2.2, the applicant stated that no initial USE data is available for the Linde 80 beltline welds; thus, operation for 32 EFPY was justified based on an EMA. However, the applicant listed a generic initial USE value of 70 ft-lb in LRA Table 4.2-2 for the Linde 80 beltline welds. The applicant calculated projected 52 EFPY USE values for the Linde 80 beltline welds based on predicted percentage decrease in USE, using Figure 2 of RG 1.99, Revision 2, and the 70 ft-lb initial USE value. All of the 52 EFPY USE values for the Linde 80 beltline welds, as listed in LRA Table 4.2-2, are projected to remain greater than the 50 ft-lb, with the exception of weld WF-182-1. Accordingly, the applicant determined that an EMA would be required to demonstrate that this weld will remain in compliance with 10 CFR Part 50, Appendix G, requirements through 52 EFPY.

The applicant provided a discussion of an EMA for the limiting beltline weld, WF-182-1, to demonstrate that the weld will remain in compliance with 10 CFR Part 50, Appendix G, through the period of extended operation. The applicant provided specific information in LRA Section 4.2.2 demonstrating that weld WF-182-1 would remain bounded by the ASME Code, Section XI, Appendix K, acceptance criteria, which are based on the weld's J-R curve and the applied J curve. The applicant's evaluation, as reported in LRA Section 4.2.2, demonstrated that weld WF-182-1 would satisfy the Appendix K acceptance criteria for Levels A, B, C, and D service loads through 52 EFPY.

The applicant referenced the B&W Owners Group (B&WOG) EMAs documented in BAW-2192P-A (Service Levels A and B) and BAW-2178P-A (Service Levels C and D). These EMA reports were previously approved by the NRC for use in determining the 40-year acceptability of B&WOG plants' RV beltline materials with low projected end-of-life USE (less than 50 ft-lb) or unknown heat-specific initial USE values. The applicant stated that these EMAs were used as the basis for acceptance of all Davis-Besse Linde 80 beltline welds through 32 EFPY. Based on the NRC-approved responses to Generic Letter (GL) 92-01, Revision 1, "Reactor Vessel Structural Integrity," the staff confirmed that the 32 EFPY EMAs documented in BAW-2178P-A and BAW-2192P-A were used as the basis for acceptance of the Linde 80 beltline welds at most B&W plants, including all Linde 80 beltline welds at Davis-Besse.

However, the staff identified several issues with the EMA for the Linde 80 beltline welds that required clarification and, by letter dated March 17, 2011, issued request for additional information (RAI) 4.2.2-1.

In RAI 4.2.2-1, the staff requested that the applicant discuss whether the EMA methods and minimum Charpy USE acceptance criteria developed in BAW-2178P-A and BAW-2192P-A are valid for demonstrating Linde 80 beltline weld acceptability through 52 EFPY, based on the calculations of the projected percentage decrease in USE for 52 EFPY, as listed in LRA Table 4.2-2. If the validity cannot be established, the staff requested that the applicant provide the reports documenting the EMA calculations for demonstrating that all RV beltline welds, including the limiting beltline weld (WF-182-1), will satisfy the requirements of 10 CFR Part 50, Appendix G, for equivalent margins against ductile fracture through the period of extended operation.

In its response dated April 15, 2011, the applicant stated that the EMA methods and acceptance criteria developed in BAW-2178P-A and BAW-2192P-A are valid for demonstrating Linde 80 beltline weld acceptability through 52 EFPY. The applicant also stated that these methodologies were based on ASME Code Case N-512, which was later incorporated into Appendix K of the ASME Code, Section XI. The applicant stated that the BAW-2178P-A and BAW-2192P-A methodologies require a comparison of J_1 to $J_{0.1}$ and a comparison of derivatives of the applied J and J-R curves at the point of their intersection. The applicant further stated that the applied J and J-R curves for the Linde 80 welds are dependent on the change in material properties but independent of the calculated 52 EFPY USE value reported in

LRA Table 4.2-2. This is because the Linde 80 weld's J-R curve is calculated using the Cu content, the projected fluence at the postulated crack tip, the metal temperature at the postulated crack tip, and the specimen thickness.

In its response to the second part of RAI 4.2.2-1, the applicant clarified the following:

- The analysis for the limiting weld was extended to 52 EFPY based on the Appendix K methods.
- The limiting RV beltine weld, WF-182-1, is the only RV beltline material with a projected 52 EFPY USE value less than 50 ft-lb, thusly requiring an EMA for the period of extended operation.
- The limiting weld's 32 EFPY EMA was previously updated to account for the MUR power uprate conditions, and the updated EMA was extended to 52 EFPY.

The staff reviewed the applicant's response to RAI 4.2.2-1 and found it acceptable because the applicant provided the information necessary for the staff to determine that the 52 EFPY EMA for weld WF-182-1 is consistent with the previously approved methods documented in BAW-2178P-A and BAW-2192P-A. Specifically, the staff confirmed that the ASME Code, Section XI, Appendix K, methods and acceptance criteria remained essentially unchanged compared to those specified in ASME Code Case N-512, which were used as the basis for the BAW-2178P-A and BAW-2192P-A EMAs for 32 EFPY. Additionally, based on the applicant's RAI response, the staff also confirmed that the methods used to establish the 32 EFPY J-R curves for Linde 80 beltline welds, as documented in BAW-2178P-A and BAW-2192P-A, are consistent with those used to establish the 52 EFPY J-R curve for weld WF-182-1 for the 52 EFPY EMA of this weld. Finally, the staff confirmed that 52 EFPY J-R values were determined using 52 EFPY fluence values at the postulated crack tip, consistent with the staff-approved EMA methods in BAW-2178P-A, BAW-2192P-A, and the ASME Code, Section XI, Appendix K. The staff's concern described in RAI 4.2.2-1 is resolved.

The staff confirmed that for Linde 80 welds, EMAs are performed using J-R curves based on the Cu-Fluence model from NUREG/CR-5729, "Multivariable Modeling of Pressure Vessel and Piping J-R Data," May 1991. Consistent with the applicant's response to RAI 4.2.2-1, the staff confirmed that for the Linde 80 welds, J-R curves are established based on Cu content, projected neutron fluence at the postulated crack tip, metal temperature at the postulated crack tip, and specimen thickness. The specimen thickness is set equal to 0.8 in., as discussed in the applicant's GL 92-01 response. This approach for specimen thickness is conservative because, as discussed in RG 1.161, "Evaluation of Reactor Pressure Vessels with Charpy Upper Shelf Energy Less Than 50 ft-lb," June 1995, the use of specimen thickness terms less than the RG 1.161 recommended value of 1.0 in. produce lower J-R curve values. The J-R models presented in NUREG/CR-5729 also reflect this trend. The J-R curve is evaluated against the applied J values, per the Appendix K acceptance criteria. Applied J values from BAW-2178P-A and BAW-2192-A were used by the applicant for the 52 EFPY EMA of the limiting weld. The applied J values are not time-dependent parameters. Therefore, the applicant's use of applied J values from BAW-2178P-A and BAW-2192-A for the 52 EFPY EMA of the limiting weld is acceptable.

As stated in NUREG/CR-5729, the Cu-fluence model is recommended only for those cases where initial Charpy USE values for the material are not available and only for Linde 80 weld material. Based on the information included in the applicant's response to GL 92-01, Revision 1, for the USE, as well as the applicant's response to RAI 4.2.2-1, the staff determined that heat-specific initial Charpy USE values are not available for the Linde 80 RV beltline weld materials at Davis-Besse. Therefore, the applicant's use of the Cu-fluence model from NUREG/CR-5729 for determining the Linde 80 weld WF-182-1 J-R curve is appropriate.

The staff also noted that RG 1.161, "Evaluation of Reactor Pressure Vessels with Charpy Upper Shelf Energy Less Than 50 ft-lb," June 1995, includes a brief discussion of material properties, as characterized by the material's J-R curve. RG 1.161 also recommends the Cu fluence model from NUREG/CR-5729 for Linde 80 weld material.

The staff evaluated the applicant's statement in LRA Section 4.2.2 regarding the revision to the initial RT_{NDT} value and the margin term for weld WF-182-1. The staff confirmed that the changes in the initial RT_{NDT} value from 2 °F to negative 80.2 °F, and the margin term from 56 °F to 59 °F, based on a staff-approved exemption to use alternative methods for determining these parameters (discussed in SER Section 4.2.3), do not affect the EMA for the limiting weld, WF-182-1. This is because EMAs use EPFM methods, which are based on the assumption that the material is operating at temperatures in the upper shelf region of the ductile-to-brittle transition curve. The large decrease in the initial RT_{NDT} and slight increase in the margin term has the net effect of decreasing the adjusted RT_{NDT} for weld WF-182-1 for a given level of embrittlement, resulting only in the extension of the upper shelf region to lower temperatures. The initial RT_{NDT} and margin terms do not enter into any of the equations for calculating applied J values or J-R values, which are the basis for EMAs using the current staff-approved methods.

In summary, the staff reviewed the applicant's response to RAI 4.2.2-1, the EMA methodology described in Appendix K, the applicant's responses to GL 92-01 (pertaining to the Linde 80 weld EMAs for 32 EFPY), and the original 32 EFPY EMAs documented in BAW-2178P-A and BAW-2192P-A. Based on its review, the staff determined that the applicant demonstrated that the limiting weld, WF-182-1, will maintain the necessary equivalent margins against fracture through 52 EFPY, as specified in 10 CFR Part 50, Appendix G.

As discussed above, the applicant stated, in LRA Section 4.2.2, that initial USE values are not available for the Linde 80 beltline welds. However, LRA Table 4.2-2 lists an initial USE value of 70 ft-lb for all Linde 80 beltline welds. Therefore, by letter dated March 17, 2011, the staff issued RAI 4.2.2-2 requesting that the applicant explain the technical basis for the RV beltline welds' initial USE value of 70 ft-lb, including the underlying statistics.

In its response dated April 15, 2011, the applicant indicated that the discussion in LRA Section 4.2.2 regarding the Linde 80 beltline welds requires a revision. The applicant stated that the 70 ft-lb initial USE value was based on an assessment from the B&WOG Master Integrated Reactor Vessel Program (MIRVP) of available unirradiated Charpy USE data for Linde 80 weld material. The applicant stated that the MIRVP established a generic mean value for all Linde 80 welds using measured unirradiated Charpy USE data from archived specimens designated with plant-specific capsules from each of the participating MIRVP plants. The applicant also stated that the statistical analysis of the unirradiated Charpy USE data, reported in B&WOG Topical Report BAW-1803, "Correlations for Predicting the Effects of Neutron Radiation on Linde 80 Submerged-Arc Welds," Revision 1, May 1991, yielded a mean initial USE value of 69.7 ft-lb. The applicant further stated that the 69.7 ft-lb value, rounded to 70 ft-lb, was established as the generic initial USE value for the Linde 80 welds at all participating MIRVP plants.

The staff reviewed the applicant's response to RAI 4.2.2-2 and determined that the applicant adequately explained how it obtained the 70 ft-lb initial USE value for the Linde 80 RV beltline welds. The staff noted that the 70 ft-lb initial USE value for the Linde 80 welds is based, approximately, on the generic mean value of the available measured Charpy USE data from archived Linde 80 weld specimens from the B&WOG MIRVP. The 70 ft-lb initial USE value was used by the applicant for calculating the projected USE at 52 EFPY for the Linde 80 welds. The 52 EFPY projected USE values for the non-limiting Linde 80 welds, WF-232 and WF-233, were determined to be acceptable by the applicant because these values were projected to be greater than the 50 ft-lb minimum USE requirement specified in 10 CFR Part 50, Appendix G.

However, the staff has concerns with the use of a generic initial USE of 70 ft-lb for Linde 80 welds, for implementation in direct projections of end-of-license USE for the period of extended operation (52 EFPY), for the following reasons:

- The mean value from a database has generally not been acceptable to the staff for establishing a generic initial USE value for a specification, class, or type of RV material because generic mean values are not statistically defensible for embrittlement calculations. In the past, the staff has generally only accepted generic initial USE values if they are based on a statistically-conservative position, such as the mean value minus two standard deviations, or the lowest value in the database.
- The BAW-1803 initial USE database has not been reviewed and approved by the staff as a statistical basis for the selection of any generic initial USE value for Linde 80 welds.

Therefore, by letter dated May 15, 2012, the staff issued RAI 4.2.2-4, requesting that the applicant demonstrate an acceptable USE evaluation for the RV beltline weld materials, WF-232 and WF-233, by providing a response to either (a) or (b) below:

(a) Provide a direct projection of USE through 52 EFPY based on either (i) measured heat-specific initial USE values from certified material test reports, or (ii) a statistically-based conservative generic initial USE value, along with a technical justification for the value.

(b) Provide EMAs for weld materials WF-232 and WF-233 in the shell region of the RV, which may use the existing methods developed in B&WOG Topical Reports BAW-2191P-A and BAW-2178P-A, or the ASME Code, Section XI, Appendix K, accounting for neutron embrittlement through 52 EFPY. EMAs for non-shell welds must use applied J-integral values based on the specific weld geometry.

In its response dated June 14, 2012, the applicant elected to provide 52 EFPY EMAs for weld materials WF-232 and WF-233, as specified in option (b) above. The applicant’s response listed the RV beltline weld components according to their location in the RV as shown in Table 4.2-1.

Table 4.2-1. RV beltline weld components material identification

Weld no.:	**Weld component description:**	**Weld material identification:**
1	Nozzle belt forging to bottom of RV inlet nozzle forging welds	WF-232/WF-233
2	Nozzle belt forging to bottom of RV outlet nozzle forging welds	WF-233
3	Upper shell forging to lower shell forging circumferential weld	WF-182-1
4	Nozzle belt forging to upper shell forging circumferential weld	WF-232/WF-233
5	Lower shell forging to dutchman forging circumferential weld	WF-232/WF-233

Each weld material identifier (i.e., WF-232, WF-182-1, etc.) corresponds to a specific heat of weld wire. The heat numbers were identified by the applicant in LRA Section 4.2.1.

The applicant stated that weld 3, which is the limiting beltline weld with respect to Cu content and 52 EFPY neutron fluence, has been found acceptable for the period of extended operation, based on the EMA documented in LRA Section 4.2.2. The staff's evaluation of the EMA for this weld is documented above. The applicant noted that weld 3 has historically been treated as the limiting weld in the RV based on material properties alone. However, since this circumferential seam weld is remote from structural discontinuities, the applicant acknowledged that other locations may potentially control due to higher stresses, even with higher toughness values for the weld material.

The applicant stated that the EMA for welds 1 and 2 above, which connect the nozzle belt forging to the bottom of the inlet and outlet nozzles, is documented in the AREVA NP, Inc. (AREVA) proprietary calculation report, Calculation 32-9110426-000, "DB-1 EMA of RPV Inlet & Outlet Nozzle-to-Shell Welds for 60 Years," dated May 2010. The applicant provided AREVA Calculation 32-9110426-000 in Enclosure B of its June 14, 2012, response letter to RAI 4.2.2-4. According to the applicant, these welds were analyzed using EPFM techniques based on the ASME Code, Section XI, Appendix K. The applicant stated that welds 1 and 2 are full penetration nozzle attachment welds that are located in the 12 in. thick nozzle belt forging section of the RV. The applicant stated that bounding stresses from the connected nozzles due to piping loads were considered in addition to pressure and thermal stresses for these welds. Regarding the 52 EFPY fluence values for the welds, the applicant stated that the higher fluence for weld 2 was selected for the J-R curve calculation for welds 1 and 2 due to the closer proximity of the larger diameter outlet nozzle weld to the reactor core. The applicant also stated that the EMA for welds 1 and 2 satisfies the acceptance criteria of the ASME Code, Section XI, Appendix K for Level A, B, C, and D service loads at 52 EFPY.

The applicant stated that welds 4 and 5 are located at thickness transitions above and below the beltline shell, respectively. Therefore, these welds require an EMA using local stresses and material properties specific to these weld locations. In its RAI response, the applicant committed (regulatory commitment) to complete the following on or before September 14, 2012:

- submit an EMA for welds 4 and 5
- revise LRA Section 4.2.2, LRA Table 4.2-2, and the corresponding USAR supplement section in LRA Section A.2.2.2 for the USE evaluation to address the EMA results for welds 1, 2, 4, and 5

By letter dated September 7, 2012, the applicant provided EMAs for welds 4 and 5 and revised the LRA sections for the USE evaluation, as committed to above. The applicant stated that the EMA for welds 4 and 5 is documented in an AREVA proprietary calculation report, Calculation 32-9184568-000, "Equivalent Margins Assessment of Davis-Besse Transition Welds for 52 EFPY," dated August 30, 2012. AREVA Calculation 32-9184568-000 was provided in Enclosure C to the September 7, 2012, RAI response. The applicant stated that this calculation demonstrates that welds 4 and 5 at Davis-Besse satisfy the requirements of the ASME Code, Section XI, Appendix K for 52 EFPY. LRA Amendment 34, provided in Enclosure A of the applicant's September 7, 2012, RAI response, revised LRA Sections 4.2.1, 4.2.2, 4.8, and A.2.2.2; and Table 4.2-2, to address the EMA results for welds 1, 2, 4, and 5.

On the basis of its review, the staff finds the applicant's response to RAI 4.2.2-4 acceptable because the applicant provided EMAs for weld materials WF-232 and WF-233 (used for welds 1, 2, 4, and 5) to demonstrate that the welds will maintain the required margins against ductile fracture through 52 EFPY, as required by 10 CFR Part 50, Appendix G. The staff reviewed the EMAs documented in the AREVA proprietary calculation reports, Calculation 32-9110426-000 and Calculation 32-9184568-000, for welds 1, 2, 4, and 5. Non-proprietary publicly available versions of the AREVA calculation reports reviewed by the staff were provided by the applicant by letters dated December 11 and 12, 2012. Based on its review, the staff determined that the EMAs for welds 1, 2, 4, and 5 demonstrate the required margins against ductile fracture for the period of extended operation, and the applicant correctly implemented the EPFM methods and acceptance criteria of the ASME Code, Section XI, Appendix K for demonstrating weld acceptability. The staff's determination is based on the findings below.

The staff finds that the fracture resistance for the welds, as characterized by the welds' J-R curve, was established using the staff-approved Cu-fluence model for Linde 80 welds, as discussed above for the limiting beltline shell weld, WF-182-1. The staff finds this appropriate because the J-R curve for the material is not dependent on the local configuration of the component, including whether the material is at or near a structural discontinuity, such as a nozzle. The staff confirmed that the Cu contents and 52 EFPY neutron fluence values used to calculate the J R curves for the welds are consistent with those provided in LRA Table 4.2-2 and, therefore, acceptable. Welds 1, 4, and 5 are fabricated from two different heats of weld wire (e.g., the inner 12 percent of weld 5 is fabricated from WF-232, and the outer 88 percent is fabricated from WF-233). The staff confirmed that the Cu content and 52 EFPY neutron fluence values used for the Level A, B, C, and D service load evaluations correspond to the weld material and fluence at the location of the postulated crack tip specified in the ASME Code, Section XI, Appendix K—the 1/4T location for Levels A and B and the 1/10T location for Levels C and D. Since the J-R curves for the welds were determined based on an NRC-approved J-R model, appropriate Cu contents, and 52 EFPY neutron fluence values, the staff finds that the applicant's J-R calculations for welds 1, 2, 4, 5 are acceptable for the period of extended operation.

For calculating the crack driving force parameter, applied J, the applicant noted that the ASME Code, Section XI, Appendix K, provides detailed procedures for calculating applied J values for materials in the cylindrical shell portion of the RV, remote from discontinuities. The Appendix K procedures specify that the applied J value is calculated as a function of applied K_I inputs for each loading condition. The specific K_I formulations prescribed in Appendix K are applicable only to the shell region, remote from structural discontinuities. The applicant stated that the applied J values for welds 1, 2, 4, and 5 were calculated by augmenting the Appendix K methods to account for the weld structural discontinuities. This approach involved performing a finite element analysis for each weld to determine the applied K_I values, based on the specific weld geometry. Based on its review of these analyses, the staff determined that the applicant's K_I inputs for determining the applied J values were appropriately calculated taking into consideration the structural discontinuities associated with the RV thickness transitions for welds 4 and 5, above, and the nozzle-to-shell transitions for welds 1 and 2, above. Applied stress intensity factors at these locations were calculated based on the appropriate internal pressures, thermal transients, and piping reactions for Level A, B, C, and D service loadings. The staff finds this approach acceptable because it is consistent with the EPFM methods of the ASME Code, Section XI, Appendix K, appropriately modified to account for the structural discontinuities at the above weld locations.

The staff finds that the applicant correctly applied the ASME Code, Section XI, Appendix K acceptance criteria for demonstrating the required margins against ductile failure. Specifically, the applicant demonstrated that the ratio, $J_{0.1}/J_1$, is significantly greater than the minimum required value of 1.0 for Level A, B, C, and D service loadings, using the appropriate safety factors on applied loads, as specified in Appendix K for each service condition. The applicant also demonstrated that flaw extensions are ductile and stable for all service conditions, based on a comparison of the derivatives of the applied J and J-R curves at their points of intersection. Therefore, the staff finds that the EMAs for welds 1, 2, 4, and 5 adequately demonstrated the required margins against ductile fracture, in accordance with 10 CFR Part 50, Appendix G.

The staff finds that LRA Amendment 34 includes the appropriate revisions to LRA Sections 4.2.1, 4.2.2, 4.8, and A.2.2.2; and LRA Table 4.2-2 to address the EMA results for welds 1, 2, 4, and 5. Specifically, LRA Sections 4.2.1 and A.2.2.2 were appropriately revised to state that 52 EFPY USE values were conservatively assumed to be below 50 ft-lb for all RV beltline welds (based on the fact the measured initial USE values are unknown); therefore, the welds were evaluated for 52 EFPY based on an EMA. LRA Section 4.2.2 was supplemented to include a discussion of the EMA results for welds 1, 2, 4, and 5. The LRA Section 4.2.2 discussion now includes a summary of EMA results for demonstrating that each weld meets the ASME Code, Section XI, Appendix K acceptance criteria for the ratio, $J_{0.1}/J_1$, and ductile flaw stability for Level A, B, C and D service loadings. All line entries for the RV beltline welds in LRA Table 4.2-2 were revised to delete the results of the 52 EFPY USE calculation, replacing them with a notation stating that the 52 EFPY USE values were conservatively assumed to be below 50 ft-lb for all RV beltline welds. Therefore, the welds were evaluated for 52 EFPY based on an EMA. Finally, LRA Sections 4.2.2 and 4.8 were supplemented to include references to the EMA calculation reports, AREVA Calculations 32-9110426-000 and 32-9184568-000, for welds 1, 2, 4, and 5. The staff finds that these LRA revisions are consistent with the applicant's response to RAI 4.2.2-4 and the EMAs performed for all RV beltline welds. Accordingly, the staff finds the revisions implemented by LRA Amendment 34 acceptable.

Based on the staff's determination regarding the acceptability of the EMAs for welds 1, 2, 4, and 5 and the revisions to LRA Sections 4.2.1, 4.2.2, 4.8, and A.2.2.2; and Table 4.2-2, the staff's concern described in RAI 4.2.2-4 is resolved, and open item (OI) 4.2-1 is closed.

LRA Section 4.2.2.2 states that Position 2.2 of RG 1.99, Revision 2, was used to calculate 52 EFPY USE values for weld WF-182-1 and forging BCC-241 using surveillance data. By letter dated March 17, 2011, the staff issued RAI 4.2.2-3 requesting that the applicant state whether the 52 EFPY USE values for these materials in LRA Table 4.2-2, based on Position 2.2 of RG 1.99, Revision 2, were calculated using at least two credible sets of USE surveillance data for these materials.

In its response dated April 15, 2011, the applicant stated that four credible sets of surveillance data were used to calculate the Position 2.2 USE value for weld WF-182-1, and five credible sets of surveillance data were used to calculate the Position 2.2 USE value for forging BCC-241. The staff reviewed the applicant's response to RAI 4.2.2-3 and determined that the applicant's use of surveillance data for the 52 EFPY USE projections for these materials is acceptable because it is consistent with Position 2.2 of RG 1.99, Revision 2, in that more than two credible sets of surveillance data were used to determine the 52 EFPY USE values for these materials. The staff's concern described in RAI 4.2.2-3 is resolved.

Based on the above evaluation, the staff determined that all Davis-Besse RV beltline forgings are projected to maintain USE values greater than 50 ft-lb through 52 EFPY. The staff also determined that the EMAs for all RV beltline welds are projected to remain acceptable through 52 EFPY based on the ASME Code, Section XI, Appendix K, acceptance criteria. Therefore, the staff determined that the applicant demonstrated that all RV beltline materials are projected to remain in compliance with the USE requirements of 10 CFR Part 50, Appendix G, during the period of extended operation.

Based on its evaluation, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of the USE and the EMAs for the Davis-Besse RV beltline region have been projected to the end of the period of extended operation and, therefore, are acceptable. Additionally, the staff finds that the applicant's TLAA meets the acceptance criterion in SRP-LR Section 4.2.2.1.1.2 because the applicant's USE analysis and EMAs have been accurately projected to the end of the period of extended operation.

4.2.2.3 USAR Supplement

LRA Section A.2.2.2 provides the USAR supplement summary description for the USE TLAA. Based on its review of the USAR supplement, as revised by LRA Amendment 34, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.2.3.2.

4.2.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of the USE and EMAs have been projected to the end of the period of extended operation. 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); therefore, it is acceptable.

4.2.3 Pressurized Thermal Shock

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3 describes the applicant's evaluation of 52 EFPY RT_{PTS} values for the RV beltline materials. In accordance with 10 CFR 50.61, the applicant calculated RT_{PTS} values by adding the initial RT_{NDT} to the predicted radiation-induced ΔRT_{NDT}, plus a margin to cover uncertainties, as prescribed by RG 1.99, Revision 2. The applicant's projected ΔRT_{NDT} values were calculated using the 52 EFPY neutron fluence at the clad-low alloy steel interface. LRA Table 4.2-3 includes 52 EFPY RT_{PTS} values for the beltline materials based on Position 1.1 from RG 1.99, Revision 2. The applicant stated that surveillance data was not used because two credible sets of RT_{PTS} surveillance data are not available for any of the RV beltline materials. The applicant stated that initial RT_{NDT} and margin values for upper shell forging to lower shell forging circumferential weld WF-182-1 and nozzle belt forging to upper shell forging circumferential weld WF-232 were obtained from BAW-2308, "Initial RT_{NDT} of Linde 80 Weld Materials," Revision 1-A, August 2005. The applicant also stated that, using the RG 1.99, Revision 2, tabulated CF values, the CF for WF-232 is 157.3. The applicant further stated that when initial RT_{NDT} values from BAW-2308, Revision 1-A are used, the CF cannot be less than 167.0. Thus, the applicant's CF in LRA Table 4.2-3 for nozzle belt forging to upper shell forging circumferential weld WF-232 is 167.0. However, for lower shell forging to Dutchman forging circumferential weld WF-232, the applicant choose to use a CF value of 157.3, per RG 1.99, Revision 2, criteria and a much higher initial RT_{NDT} and M from the RVID to conservatively determine the RT_{PTS} value for this weld.

According to the applicant, the RT_{PTS} values for all RV beltline materials are projected to remain below the PTS screening criteria at 60 years. The applicant stated that weld WF-182-1 is the limiting RV beltline material, with an RT_{PTS} value of 182.2 °F, as compared to an acceptance criterion of 300 °F for circumferential welds.

Based on the information above, the applicant concluded that the RT_{PTS} values for the RV beltline materials have been projected to remain acceptable to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.2.3 on PTS to confirm, pursuant to 10 CFR 54.21(c)(1)(ii), that the PTS analysis for the RV beltline materials has been projected to the end of the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.2.3.1.2.2, which state that the documented results of the revised PTS analysis based on the projected neutron fluence at the end of the period of extended operation are reviewed for compliance with 10 CFR 50.61. The staff used the applicant's 60-year projected neutron fluence values for the RV beltline materials as the basis for determining whether the RV beltline materials would have acceptable RT_{PTS} values for the period of extended operation. The staff reviewed the applicant's 60-year RT_{PTS} values against the RT_{PTS} screening criteria in 10 CFR 50.61, which establish the upper limits on acceptable values of RT_{PTS}.

The staff's review of LRA Section 4.2.3 covered the applicant's PTS methodology and RT_{PTS} calculations for the end of the period of extended operation, considering the effects of neutron embrittlement. In 10 CFR 50.61, the required methodology for calculating these RT_{PTS} values is provided, which is similar to the calculation methodology described in RG 1.99, Revision 2, for determining the ART values used for P-T limits calculations. Pursuant to 10 CFR 50.61, RT_{PTS} calculations account for the effects of neutron embrittlement and incorporate any relevant RV surveillance capsule data as part of the applicant's implementation of its RV Materials Surveillance Program. Also in 10 CFR 50.61, RT_{PTS} is defined as the RT_{NDT} value evaluated at the clad/base metal interface using the projected end-of-license fluence. RT_{PTS} values for all RV beltline materials shall not exceed the screening criteria specified in 10 CFR 50.61(b)(2), except as provided in 10 CFR 50.61(b)(3)–10 CFR 50.61(b)(7). The PTS screening criteria are 270 °F for RV plates, forgings, and axial welds and 300 °F for circumferential welds.

LRA Table 4.2-3 lists the projected 52 EFPY RT_{PTS} values for all RV beltline materials, including all input data used in the calculations. The staff confirmed that all 52 EFPY RT_{PTS} values are correctly calculated using the methods specified in 10 CFR 50.61 (as modified by an NRC-approved exemption discussed below) and RG 1.99, Revision 2, Position 1.1. At the clad/low alloy steel interface of the RV wall, 52 EFPY fluence values were appropriately used for the RT_{PTS} calculations. All Cu and Ni content values listed in LRA Table 4.2-3 are consistent with those in the RVID. With respect to the initial RT_{NDT} values and the M values for welds WF-182-1 and WF-232, the staff confirmed that these values were determined based on the methods described in BAW-2308, Revision 1-A. The staff confirmed that the applicant received NRC approval, in a letter dated December 14, 2010, for an exemption to use the BAW-2308, Revision 1-A, methods as alternatives to 10 CFR Part 50, Appendix G, and 10 CFR 50.61 requirements in determining the initial RT_{NDT} and σ_i terms. The staff also confirmed that, in a letter dated January 28, 2011, License Amendment No. 282 authorized the TS changes for referencing the BAW-2308, Revision 1-A and 2-A methods in the TS 5.6.4 requirements for the

P-T limits report (PTLR) methodology. The initial RT_{NDT} values and M values for all other RV beltline materials are consistent with those listed in the RVID. Accordingly, the staff found the applicant's 52 EFPY RT_{PTS} values acceptable because all RV beltline materials are projected to maintain RT_{PTS} values less than the applicable screening criteria specified in 10 CFR 50.61 at the end of the period of extended operation.

Based on its review of the applicant's RT_{PTS} calculations, the staff found that the applicant accurately calculated the 52 EFPY RT_{PTS} values for all Davis-Besse RV beltline materials. Accordingly, the staff determined that the applicant demonstrated that all RV beltline materials at Davis-Besse are projected to remain in compliance with the PTS screening requirements of 10 CFR 50.61 through the end of the period of extended operation.

Based on its evaluation, as discussed above, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of PTS for the Davis-Besse RV has been projected to the end of the period of extended operation, and all of the RT_{PTS} values remain in compliance with the PTS screening requirements of 10 CFR 50.61 through the end of the period of extended operation. Additionally, the staff finds that the applicant's TLAA meets the acceptance criterion in SRP-LR Section 4.2.2.1.2.2 because the applicant's PTS analysis has been accurately projected to the end of the period of extended operation.

4.2.3.3 USAR Supplement

LRA Section A.2.2.3 provides the USAR supplement summary description for the PTS TLAA evaluation. Based on its review of the USAR supplement, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.2.3.2.

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of PTS has been projected to the end of the period of extended operation. 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), and, therefore, is acceptable.

4.2.4 Pressure-Temperature Limits

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 describes the applicant's TLAA for P-T limits. The 52 EFPY ART values at the one-quarter of the vessel thickness (1/4T) and three-quarters of the vessel wall thickness (3/4T) locations for all RV beltline materials were provided in LRA Table 4.2-4. These ART values are based on the use of RG 1.99, Revision 2, Position 1.1. The applicant calculated the 1/4T and 3/4T fluence values for the Davis-Besse RV beltline shell materials in accordance with RG 1.99, Revision 2, using the stainless steel cladding thickness, low allow steel vessel wall depths, and the neutron fluence values at the inner wetted surface of the RV listed in LRA Table 4.2-1. According to the applicant, fluence values at the 1/4T and 3/4T locations for the RV inlet and outlet nozzle and associated welds that connect the nozzles to the nozzle belt forging were obtained by adding the attenuation from both the inside and outside surface. Position 2.1 from RG 1.99, Revision 2, was not used since two sets of credible ART surveillance data were not available. Initial RT_{NDT} values and M values for welds WF-182-1 and WF-233 were obtained from BAW-2308, Revision 1-A. The applicant's P-T limit curves and supporting ART calculations are established in the Davis-Besse PTLR. P-T limits are valid only for the operating period (corresponding to a specific RV neutron fluence) specified in the PTLR, and the P-T limits expire upon reaching the fluence limit in the PTLR. In accordance with Davis-Besse TS 5.6.4 requirements, the PTLR shall be periodically updated to include new P-T limits based on revised neutron fluence values corresponding to later operating periods or new credible RV surveillance data, and the revised PTLR shall be submitted to the NRC. The applicant stated that a revised PTLR will be submitted to the NRC in accordance with TS 5.6.4 requirements, before the current P-T limits expires. According to the applicant, the P-T limit curves, as established in the PTLR, will be updated as necessary through the period of extended operation as part of the RV Surveillance Program.

Based on the information above, the applicant concluded that the effects of neutron embrittlement on the RCS P-T limits will be adequately managed during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 4.2.4 on P-T limits to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of RV neutron embrittlement on the P-T limits will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR, Section 4.2.3.1.3.3, which state that updated P-T limits for the period of extended operation must be available prior to entering the period of extended operation. SRP-LR, Revision 2, Section 4.2.3.1.3.3 also states that either the 10 CFR 50.90 process for P-T limits located in the TS limiting conditions for operation (LCOs) or the TS administrative controls process for P-T limits contained in PTLRs can be considered adequate aging management programs (AMPs) within the scope of 10 CFR 54.21(c)(1)(iii), such that P-T limits will be appropriately maintained through the period of extended operation.

10 CFR Part 50, Appendix G, provides fracture toughness requirements for ferritic materials in the RCPB, including requirements for calculating the RCS P-T limits. Section IV.A.2 of 10 CFR Part 50, Appendix G requires that P-T limits be at least as conservative as those determined in accordance with the ASME Code, Section XI, Appendix G. The P-T limits shall also incorporate a 40 °F temperature shift above the ASME Code, Section XI, Appendix G, limits for core criticality and incorporate the minimum temperature requirements, as specified in Table 1 of the rule. Additionally, the rule requires that the P-T limit calculations account for the effects of neutron radiation on the properties of the RV beltline materials and that these calculations incorporate relevant RV surveillance capsule data. The NRC's guidelines for calculating the effects of neutron radiation on the RV beltline material properties, specifically the ART values, are provided in RG 1.99, Revision 2. P-T limits must be established for HU/CD operations with the core critical and not critical, for hydrostatic pressure tests, and for leak testing conditions. P-T limits specify the maximum RCS HU/CD rates as well as the EFPY operating period corresponding to the fluence level for which the curves are valid. Since the ART for RV beltline materials increase as a function of neutron fluence, which changes with time, the P-T limits must be updated to ensure that they bound the plant's operating conditions.

LRA Section 4.2.4 provided a discussion of the P-T limits. The current Davis-Besse P-T limits, valid through 32 EFPY or April 22, 2017, whichever is earlier, are established in the Davis-Besse PTLR. The content of the Davis-Besse PTLR is administratively controlled in accordance with Davis-Besse TS Section 5.6.4. TS 5.6.4a specifies that P-T limits shall be established in the PTLR for all required operating and leak testing conditions for operation of the RCS in accordance with TS LCO 3.4.3, which requires that the applicant operate the RCS within the limits specified in the PTLR. TS 5.6.4b specifies the analytical methods used to calculate the P-T limits contained in the PTLR, including the NRC-approved alternative methodology described in BAW-2308, Revision 1-A and Revision 2-A, for determining the initial RT_{NDT} and M values for the Linde 80 weld materials. TS 5.6.4c requires that the PTLR be updated for each RV fluence period or for any revision or supplement thereto, thereby meeting the acceptance criterion from SRP-LR Section 4.2.2.1.3.3 that allows the P-T limits to be managed by the TS administrative controls process for P-T limits contained in PTLRs. The applicant will update the PTLR for new fluence limits prior to operating beyond the current period. The Davis-Besse TS requirements concerning RCS operation and PTLR content ensure that the structural integrity of the RCPB will be maintained in accordance with the requirements of 10 CFR Part 50, Appendix G. Additionally, the applicant specified that the RV Surveillance Program, described in LRA Section B.2.35, will maintain the Davis-Besse P-T limit curves to ensure compliance with 10 CFR Part 50, Appendix G, through the end of the period of extended operation. Since information from the RV Surveillance Program, such as neutron fluence and updated RT_{NDT} values, will be used to adjust the P-T limits as necessary, the staff finds the RV Surveillance Program is also appropriate for managing the P-T limits TLAA.

LRA Table 4.2-4 provided 52 EFPY ART values at the 1/4T and 3/4T locations for all RV beltline materials. The staff confirmed that the 52 EFPY ART values were calculated in accordance with RG 1.99, Revision 2, Position 1.1. The Cu and Ni content values used for the ART calculations are consistent with those listed in the PTLR and the RVID. The staff confirmed that initial RT_{NDT} values and M values listed in LRA Table 4.2-4 for welds WF-233 and WF-182-1 were determined using the alternative methods for Linde 80 welds described in BAW-2308, Revision 1-A. All other initial RT_{NDT} values and M values are consistent with those listed in the RVID. The staff noted that the current P-T limits in the PTLR are for 32 EFPY, but the ART values listed there are for 52 EFPY, and these ART values are consistent with those provided in LRA Table 4.2-4. As discussed in SER Section 4.2.3.2, the applicant is authorized, in License Amendment No. 282, to use the alternative methods of BAW-2308, Revision 1-A and Revision 2-A, for determining the initial RT_{NDT} values and M values for these Linde 80 weld materials. Therefore, future Davis-Besse PTLRs may use the BAW-2308, Revision 1-A and Revision 2-A, methods for determining RT_{NDT} values and M values for Linde 80 beltline welds.

The staff noted that Position 2.1 of RG 1.99, Revision 2, was not used for the 52 EFPY ART calculation because two sets of credible surveillance data are not available for determining the ART values for the RV beltline materials. The staff verified that the use of Position 1.1 of RG 1.99 for the ART calculation is consistent with the latest 32 EFPY PTLR, which was approved by the staff in an SE titled "Davis-Besse Nuclear Power Station, Unit No. 1 Safety Evaluation Regardng the Reactor Coolant System Pressure and Temperature Limits Report, Revision 1," issued by letter dated May 11, 2012. This is also consistent with the staff's RVID. Section 3.3 of the PTLR states that ART values were not calculated using surveillance data since the data was determined to be non-credible. The 32 EFPY PTLR provides a reference to the vendor report that documents the credibility determination, based on the procedures of RG 1.99, Revision 2. Therefore, the licensee's use of the methods of Position 1.1 of RG 1.99, Revision 2 for the 52 EFPY ART calculation is acceptable.

The staff noted that LRA Section 4.2.4 states that “[f]luence values at the 1/4T and 3/4T locations for the RV inlet and outlet nozzles and associated welds that connect the nozzles to the nozzle belt forging were obtained by adding the attenuation from both the inside and outside surface.” The staff confirmed the adequacy of this approach by independently calculating the 1/4T and 3/4T neutron fluence values using the attenuation equation (equation 3) in RG 1.99, Revision 2. At the 1/4T location, the staff determined that the applicant’s fluence values are approximately thirteen percent higher than the values calculated by the staff using equation 3 from the RG. At the 3/4T location, the staff determined that the applicant’s fluence values are approximately 3.8 times higher than the values calculated by the staff using equation 3 from RG 1.99. Therefore, the applicant’s method for calculating 1/4T and 3/4T neutron fluence values for these components leads to higher and therefore more conservative ART values than those suggested in RG 1.99, Revision 2. Accordingly, the staff finds acceptable the applicant’s methods for calculating neutron fluence values at the 1/4T and 3/4T locations for the RV inlet and outlet nozzles and associated welds that connect these nozzles to the nozzle belt forging, because the values used are more conservative than those calculated from the approved guidance of RG 1.99, Revision 2.

The current Davis-Besse PTLR contains P-T limit curves that are valid through 32 EFPY, calculated using adjusted RT_{NDT} values for the limiting RV beltline shell material. The current Davis-Besse PTLR addresses P-T limit curve calculations for only the limiting RV beltline shell material and the staff could find no indication that the P-T limit calculations considered any RV materials or other RCPB components outside the RV beltline shell region.

The staff notes that 10 CFR Part 50, Appendix G, Paragraph IV.A states the following:

> The pressure-retaining components of the [RCPB] that are made of ferritic materials must meet the requirements of the ASME Code, [Section III], supplemented by the additional requirements set forth in [Paragraph IV.A.2, ‘Pressure-Temperature Limits and Minimum Temperature Requirements’], for fracture toughness….

Therefore, 10 CFR Part 50, Appendix G requires that P-T limits be developed for the ferritic materials in the RV beltline (neutron fluence greater than or equal to 1×10^{17} n/cm^2, E greater than 1 MeV), as well as ferritic materials not in the RV beltline (neutron fluence less than 1×10^{17} n/cm^2, E greater than 1 MeV). Further, 10 CFR Part 50, Appendix G requires that all RCPB components must meet the ASME Code, Section III requirements. The relevant ASME Code, Section III requirement that will affect the P-T limits is the lowest service temperature requirement for all RCPB components specified in Section III, NB-2332(b).

The staff was concerned that consideration of non-RV beltline shell materials and other ferritic RCPB components may define P-T curves that are more limiting than those calculated for the RV beltline shell materials. This may be due to the following factors:

- RV nozzles, penetrations, and other discontinuities, have complex geometries that may exhibit significantly higher stresses than those for the RV beltline shell region. These higher stresses can potentially result in more restrictive P-T limits, even if the reference temperature (RT_{NDT}) for these components is not as high as that of RV beltline shell materials that have simpler geometries.
- Ferritic RCPB components that are not part of the RV may have initial RT_{NDT} values, which may define a more restrictive lowest operating temperature in the P-T limits than those for the RV beltline shell materials.

Therefore, by letter dated May 31, 2012, and as supplemented by letter dated July 26, 2012, the staff issued RAI 4.2.2-4, requesting that the applicant describe how the P-T limit curves to be developed for use in the period of extended operation, and the methodology used to develop these curves, will consider all RV materials (beltline and non-beltline) and the lowest service temperature of all ferritic RCPB materials, consistent with the requirements of 10 CFR Part 50, Appendix G.

In its response dated August 24, 2012, the applicant stated that it used the methods described in B&W topical report BAW-10046-A, Revision 2, “Methods of Compliance with Fracture Toughness and Operational Requirements of 10 CFR Part 50, Appendix G,” dated June 1986, to develop the P-T limits for Davis-Besse. The applicant also stated that this report addresses all beltline and non-beltline RCPB components. The applicant noted that the staff reviewed and approved the methods described in the topical report for implementation by all B&W plants in its April 30, 1986, SE.

The applicant stated that the current Davis-Besse PTLR includes P-T limits that are valid until 32 EFPY or April 22, 2017, whichever occurs first. These P-T limits were generated using the methods of BAW-10046-A, Revision 2, and the ASME Code, Section XI, Appendix G. The applicant also stated that non-beltline RCPB components have always been considered in the development of P-T limits, based on the analyses performed in BAW-10046-A, Revision 2. BAW-10046-A, Revision 2, determined that the three most controlling regions of the RCPB relative to the P-T limits are the RV closure head region, the RV outlet nozzles, and the RV beltline region. According to the applicant, BAW-10046-A, Revision 2, determined that the inside corner region of the RV outlet nozzles are subject to the highest local stresses due the nozzles’ large diameter, and the RV outlet nozzles are more limiting relative to stress than any other RCPB nozzle or piping component. The applicant stated that, considering the above stress concentration effects, the current P-T limit curves are defined by the limiting RV beltline shell material, weld WF-182-1, based on this weld’s high degree of embrittlement relative to the outlet nozzles.

With regard to replacement ferritic RCPB components, such as the RV closure head and any future replacement of RCPB components, which would not necessarily be bounded by the RT_{NDT} values assumed in BAW-10046-A for these components, the applicant stated that the ASME Code, Section III, NB-3211(d) requires that protection against nonductile fracture be provided by satisfying one of the following provisions:

> 1. performing an evaluation of service and test conditions by methods similar to those contained in Appendix G [of the ASME Code, Section III]; or
>
> 2. for piping, pump, and valve material with thickness greater than 2.5 in. (64 mm) establishing a lowest service temperature that is not lower than RT_{NDT} (NB-2331) + 100°F (56°C);
>
> 3. for piping, pump, and valve material with thickness equal to or less than 2.5 in (64 mm), the requirements of NB-2332(a) shall be met at or below the lowest service temperature as established in the design specification.

Therefore, for replacement components, the applicant noted that an ASME Code, Section III analysis is required to ensure that the new component is bounded by the ASME Code, Section XI, Appendix G, analysis of the RV used to derive the P-T limits.

The staff agreed with the applicant’s statement that applying the requirements of the ASME Code, Section III, NB-3211(d) (which includes the lowest service temperature requirement of NB-2332(b)) will ensure that the fracture toughness of replacement ferritic RCPB components at Davis-Besse will comply with the requirements of 10 CFR Part 50, Appendix G. The original RCPB components at Davis-Besse were designed and fabricated to meet the requirements of the ASME Code, Section III, 1968 edition through summer 1968 addenda. This Code edition and addenda predate the lowest service temperature and fracture toughness requirements of NB-3211(d) and NB-2332(b). However, for original ferritic RCPB components not part of the RV, BAW-10046-A, Revision 2, provides assurance that adequate protection against nonductile fracture is provided, based on the establishment of bounding P-T limits for the RV.

The staff notes that, although the BAW-10046-A, Revision 2, methodology, which is used for the development of the current P-T limits for Davis-Besse, has been determined to be acceptable by the staff for demonstrating compliance with 10 CFR Part 50, Appendix G, this methodology assumes that all RV components outside the beltline shell region are not subject to significant neutron embrittlement. Specifically, the BAW-10046-A, Revision-2, analysis of the RV outlet nozzles assumes the nozzles are in the unirradiated state. The staff agrees that the effects of neutron irradiation on the nozzles should be insignificant during the initial 40-year operating period. However, for the period of extended operation, the outlet nozzles are beltline components, and at 52 EFPY, the projected ART value for the nozzles is 82 °F at the 1/4T location, which is significantly greater than the unirradiated RT_{NDT} value of 3 °F. The staff determined that future P-T limit curves to be developed for the period of extended operation should take into consideration both neutron embrittlement effects and high localized stresses at the nozzles' inside corner region to ensure compliance with 10 CFR Part 50, Appendix G, which the initial RAI response did not address.

On October 23, 2012, the staff held a telephone conference call with the applicant to discuss its concerns with the applicant's response to RAI 4.2.4-1. During the telephone conference call, the staff stated that the applicant's response did not provide information that addressed how future P-T limit curves would be developed for the period of extended operation taking into account the neutron embrittlement effects on the extended beltline region and the localized stresses of the inlet and outlet nozzles. During the telephone conference call, the applicant stated that the P-T limit curves are currently limited to 32 EFPY and that additional analysis is required to develop new curves for operation during the period of extended operation. Based on the telephone conference call discussion, the applicant agreed to submit a supplemental response to RAI 4.2.4-1, along with the appropriate LRA revisions, to address how P-T limits for the period of extended operation will take into consideration nozzle embrittlement.

In its supplemental response dated November 2, 2012, the applicant stated that the RV beltline region for 40 years includes only RV shell forgings and welds, whereas the beltline region for the period of extended operation also includes the inlet and outlet nozzles, the Dutchman forging, welds connecting the inlet and outlet nozzles to the nozzle belt forging, and the weld connecting the Dutchman forging to the lower shell forging (collectively referred to as the extended beltline components). Of all extended beltline components, the outlet nozzles are projected to have the highest ART, 82 °F at 52 EFPY, as shown in LRA Table 4.2-4. The applicant stated that P-T limits for the period of extended operation will take into consideration the evaluation of the effects of neutron embrittlement for the extended beltline materials as well as the high localized stresses in the closure head region of the RV and the inside corner of the RV outlet nozzles, which are the largest diameter nozzles in the RCPB.

The applicant's supplemental response included LRA Amendment 35, which revised LRA Section 4.2.4 and the corresponding USAR supplement section provided in LRA Section A.2.2.4

to state that future P-T limit curves for the period of extended operation will be developed based on an evaluation of the effects of neutron embrittlement for the 60-year beltline materials, the stresses in the RV closure head region, and the stresses in the RV outlet nozzles. The revision to LRA Sections 4.2.4 and A.2.2.4 included a comprehensive list of all 60-year beltline components, which includes the 40-year beltline components and the extended beltline components discussed above.

On May 21, 2013, the staff held a telephone conference call with the applicant to request that additional information be added to LRA Section 4.2.4 and and the USAR supplement (LRA Section A.2.2.4) to ensure that the effects of embrittlement on future P-T limit calculations will be addressed for any RV materials that could experience inside surface fluence greater than 1.0E17 n/cm^2 (E > 1.0 MeV), consistent with Revision 2 of the GALL Report. Therefore, by letter dated June 3, 2013, the applicant provided LRA Amendment 43, which further supplemented LRA Sections 4.2.4 and A.2.2.4 to state that the revised P-T limits for the period of extended operation will be generated by taking into consideration the effects of embrittlement on the 60-year RV beltline and extended beltline materials (as listed in these LRA sections), as well as any other components that could experience 52 EFPY inside surface fluence greater than 1.0E17 n/cm^2 (E > 1.0 MeV) during the period of extended operation.

Based on its review, the staff finds the applicant's response, as supplemented, acceptable because the applicant appropriately described how the P-T limit curves to be developed for use in the period of extended operation will consider all ferritic RCPB components, consistent with the requirements of 10 CFR Part 50, Appendix G. Additionally, the applicant adequately described how future P-T limits will consider the effects of neutron embrittlement on all 60-year RV beltline components, as well as the impact of the high localized stresses at the inside corner of the outlet nozzles and the RV closure head region. For ferritic RCPB components that are not part of the RV, which may be replaced in the future, the staff finds that the applicant adequately described how the fracture toughness of these components will be evaluated in accordance with ASME Code, Section III requirements, and any effects on the P-T limits will be accounted for. BAW-10046-A, Revision 2, provides the basis that the fracture toughness of existing ferritic RCPB components outside the RV complies with 10 CFR Part 50, Appendix G, requirements.

The staff finds that the LRA Amendment 35 revisions to LRA Sections 4.2.4 and A.2.2.4 ensure that the effects of both neutron embrittlement and stress concentrations in the extended beltline components will be addressed in future analyses for developing P-T limits for the period of extended operation. Therefore, these LRA revisions provide adequate assurance that future P-T limit curves will be developed such that they are bounding for all ferritic RCPB materials during the period of extended operation, consistent with the requirements of 10 CFR Part 50, Appendix G. Based on the information above, the staff's concern described in RAI 4.2.4-1 is resolved, and OI 4.2.4-1 is closed.

The staff reviewed the applicant's P-T limits TLAA in LRA Section 4.2.4, the applicant's response to RAI 4.2.4-1, the Davis-Besse PTLR, and the TS requirements for RCS P-T limits and PTLR contents, as documented above. Based on this review, the staff found that the applicant adequately demonstrated that the P-T limits at Davis-Besse will be managed under the TS administrative controls process and the RV Surveillance Program to ensure compliance with the requirements of 10 CFR Part 50, Appendix G, through the end of the period of extended operation.

Based on the above evaluation, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the Davis-Besse P-T limits will be adequately managed by the TS administrative controls process and the RV Surveillance Program for the period of extended operation. Additionally, the staff finds that the applicant's TLAA meets the acceptance criterion in SRP-LR Section 4.2.2.1.3.3 because the P-T limits will be adequately managed by the TS administrative controls process for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii).

4.2.4.3 USAR Supplement

LRA Section A.2.2.3 provides the USAR supplement summary description for the P-T limits TLAA evaluation. Based on its review of the USAR supplement, as revised by LRA Amendment 35, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.2.3.2.

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the RCS P-T limits will be adequately managed for the period of extended operation. 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), and, therefore, is acceptable.

4.2.5 Low-Temperature Overpressure Protection Limits

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 describes the applicant's TLAA for the low-temperature overpressure protection (LTOP) limits. The applicant stated that LTOP is provided in one of the following ways at Davis-Besse:

- Administrative controls are used to assure protection within the existing P-T limits when the pressurizer PORV and the safety valves are not providing over-pressure protection.
- A relief valve in the decay heat removal system suction piping is placed into service when the RCS temperature is below 280 °F.

The applicant stated that the TS LTOP limits were developed based on the NRC-approved methodology in topical report BAW-10046-A, "Methods of Compliance with Fracture Toughness and Operational Requirements of 10 CFR Part 50, Appendix G," Revision 2, June 1986. According to the applicant, maintaining the LTOP limits in accordance with ASME Code, Section XI, Appendix G limits, as required by Appendix G of 10 CFR Part 50, assures that the effects of aging on the RCS will be adequately managed for the period of extended operation. The applicant stated that the LTOP limits will be managed during the period of extended operation under the RV Surveillance Program.

Based on the information above, the applicant concluded that the effects of neutron embrittlement on the LTOP limits will be appropriately managed during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.5.2 Staff Evaluation

The staff reviewed LRA Section 4.2.5 on the LTOP limits to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of RV neutron embrittlement on the LTOP limits will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant shall propose to manage the aging effects associated with the TLAA using an AMP in the same manner as described in the integrated plant assessment (IPA) in 10 CFR 54.21(a)(3). SRP-LR Section 4.7.3.1.3 also states that the applicable AMP is reviewed to verify that the effects of aging on the intended functions are adequately managed consistent with the CLB for the period of extended operation.

In LRA Section 4.2.5, the applicant proposed to manage the aging effects associated with the LTOP limits using the RV Surveillance Program, which is described in LRA Section B.2.35. As stated in LRA Section 4.2.5, LTOP is provided through (1) TS administrative controls, which are used to assure protection within the existing P-T limits when the pressurizer PORV and the two pressurizer safety valves are not in service, and (2) a relief valve in the decay heat removal system suction piping which is placed into service when the RCS temperature is below 280 °F. TS LCOs for the RCS specify that the pressurizer, pressurizer PORV, and pressurizer safety valves shall be operable when the reactor core is critical (Modes 1 and 2—reactor power operation and startup, respectively, as defined in TS Table 1.1-1) or the reactor is in hot standby (Mode 3).

The Davis-Besse LTOP system limits are established directly in the Davis-Besse TSs. Davis-Besse TS 3.4.12 provides LTOP requirements, wherein LCO 3.4.12 specifies that the decay heat removal system relief valve shall be operable with a lift setting less than or equal to 330 pounds per square inch gauge (psig) when the reactor is in hot shutdown (Mode 4), cold shutdown (Mode 5), or Mode 6 (refueling) with the RV head in place. Consistent with information provided in LRA Section 4.2.5, TS Table 1.1 specifies that, when the reactor is in Modes 4, 5, or 6, RCS average temperature shall be less than 280 °F. The staff agreed that these TS LTOP limits are appropriate for ensuring protection of the RV from low-temperature overpressurization events because the applicability of the LTOP TS requirements to Modes 4, 5, and 6 ensures that all ferritic RV materials will be protected from brittle fracture due to overpressurization events at temperatures less than 280 °F, which exceeds the 52 EFPY ART values for the RV beltline materials by a substantial margin. The staff also determined that the decay heat removal system relief valve lift setpoint of less than or equal to 330 psig for Modes 4, 5, and 6, as specified in TS LCO 3.4.12, also ensures that that RCS operation is bounded by the CLB P-T limits, as established in the PTLR, at temperatures less than 280 °F. Therefore, the staff found that the applicant's LTOP limits are appropriately maintained in the TSs to ensure that the RCS is operated in accordance with 10 CFR Part 50, Appendix G requirements.

The staff confirmed that the current TS requirements for LTOP are valid through 32 EFPY, and the Davis-Besse LTOP limits will be managed through continued implementation of the RV Surveillance Program during the period of extended operation, as stated by the applicant in LRA Section 4.2.5. Since the LTOP limits are related to the P-T limits, and the temperature at which the LTOP system must be operable is related to the limiting material RT_{NDT}, both of which are adjusted based on information from the RV Surveillance Program, the staff finds the RV Surveillance Program is appropriate for management of the LTOP limits. All future revisions to the TS LTOP requirements will be implemented through the license amendment process, in accordance with 10 CFR 50.90.

Based on the above considerations and the staff's determination that the P-T limits will be adequately managed for the period of extended operation, as discussed in SER Section 4.2.4, the staff determined that the Davis-Besse LTOP limits will be appropriately managed by a combination of the TS administrative controls process and the RV Surveillance Program for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

Based on the above evaluation, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the Davis-Besse LTOP limits will be adequately managed by the TS administrative controls process and the RV Surveillance Program for the period of extended operation. Additionally, the staff finds that the applicant's TLAA meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the effects of aging on the intended function will be adequately managed for the period of extended operation.

4.2.5.3 USAR Supplement

LRA Section A.2.2.5 provides the USAR supplement summary description for the LTOP limits TLAA evaluation. Based on its review of the USAR supplement, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.7.3.2.

4.2.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the RCS LTOP limits will be adequately managed for the period of extended operation. 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), and, therefore, is acceptable.

4.2.6 Intergranular Separation (Underclad Cracking)

4.2.6.1 Summary of Technical Information in the Application

LRA Section 4.2.6 describes the applicant's TLAA for underclad cracking in the Davis-Besse SA-508, Class 2 RV forgings. According to the applicant, BAW-10013-A, "Study of Intergranular Separations in Low Alloy Steel Heat Affected Zones under Austenitic Steel Weld Cladding," February 1972, documents a fracture mechanics analysis for demonstrating that the critical crack size required to initiate fast fracture of underclad cracks is several orders of magnitude greater than the assumed maximum flaw size plus predicted flaw growth due to design fatigue cycles. The applicant stated that this analysis is based on 40 year cyclic loading, and a 32 EFPY assessment of radiation embrittlement for determining end-of-life fracture toughness properties. The LRA states that the report concluded that the intergranular separations found in B&W vessels would not lead to vessel failure during a 40-year/32 EFPY operating life.

The applicant stated that the evaluation of underclad cracking in the Davis-Besse SA-508 Class 2 forgings for the period of extended operation is consistent with the methodology described in Appendix C of BAW-2251-A, "Demonstration of the Management of Aging Effects for the Reactor Vessel," August 1999. The applicant also stated that the plant-specific analysis was performed for 60-years using the 52 EFPY fracture toughness information, applied stress intensity factor solutions, and fatigue crack growth correlations for SA-508, Class 2 material.

The applicant stated that the underclad crack analysis was applied to the beltline and the nozzle belt regions of the RV and that both axially- and circumferentially-oriented flaws were considered in the evaluation. The applicant stated that for an axially-oriented flaw, the limiting location for satisfying the requirements of IWB-3612 is at the lower end of the nozzle belt forging, where the thickness transitions from 8.438 to 12.0 in. The applicant stated that the maximum crack growth, considering normal/upset condition transients with associated 60-year projected cycles for the period of extended operation was determined to be 0.043 in., which results in a final flaw depth of 0.396 in. The applicant also stated that the maximum applied stress intensity factor for normal and upset conditions results in a fracture toughness margin of 3.67, which is greater than the acceptance criterion of 3.16. The applicant further stated that the maximum applied stress intensity factor for emergency and faulted conditions results in a fracture toughness margin of 1.43, which is greater than the acceptance criterion of 1.41. The applicant concluded that the postulated underclad cracks in the Davis-Besse RV forgings are acceptable for continued safe operation through the period of extended operation.

Based on the information above, the applicant concluded that its analysis of RV forging underclad cracking has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

LRA Section 4.2.6, as amended by letter dated March 9, 2012 (LRA Amendment 24), includes the applicant's disposition of intergranular separation (underclad cracking) flaw growth for its new RV head installed in the fall of 2011. The applicant stated that this TLAA was applicable to the RV closure head that was in place at the time of development of the LRA, but it does not apply to the new replacement RV closure head installed during the October 2011 outage in accordance with Confirmatory Action Letter No. 3-10-001. The applicant stated that the replacement RV closure head installed during the October 2011 outage was fabricated using SA-508, Class 3 material that is not susceptible to intergranular separations. Therefore, amended LRA Table 4.1-1 notes that the underclad cracking flaw growth is not a TLAA for the RV head.

4.2.6.2 Staff Evaluation

The staff reviewed LRA Section 4.2.6 on RV forging underclad cracking to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the applicant provided an acceptable analysis of projected underclad cracking in its SA-508, Class 2 RV forgings for the period of extended operation. The staff also reviewed this section to verify that the TLAA on intergranular separation (underclad cracking) flaw growth does not apply to its new RV closure head replaced in fall 2011.

In Confirmatory Action Letter Number 3-10-001, the applicant voluntarily committed to shutdown the Davis-Besse plant no later than October 1, 2011, and replace the RV closure head. The applicant stated that the replacement RV closure head/head flange was fabricated using SA-508 Class 3 material, which is not susceptible to intergranular separations. The staff reviewed the applicant's Confirmatory Action Letter No. 03-10-001 and confirmed that the vendor is to supply the replacement RV head with SA-508, Class 3 forging, and that the SA-508 specification for Class 3 materials reduced the maximum allowable chromium alloying content from those specified in the SA-508 specification for corresponding Class 2 forging materials. The staff noted that industry literature indicates that this change in the alloying content makes the SA-508, Class 3 forging materials more resistant to the phenomenon of underclad cracking than are SA-508, Class 2 forging materials. By letter dated November 7, 2011 (L-11-301), the applicant notified the NRC that it had completed the actions required by Confirmatory Action Letter 3-10-001, including replacing the RV head. The attachment to this letter specified that, as of October 30, 2011, the new RV head was placed into containment and the prior head had been removed from containment.

On September 30, 2011, the NRC completed an integrated inspection at Davis-Besse. The results of this inspection are documented in Davis-Besse Integrated Inspection Report 05000346/2011004, dated October 26, 2011. As documented in the inspection report, the NRC inspector reviewed the following documents related to the replacement RV closure head/head flange: (1) Certified Material Test Report: JQA-02-173, "Closure Head Forging—Japan Steel Works, LTD," dated August 27, 2002; and (2) Drawing: AREVA-02-5053158E-00, "Replacement Reactor Vessel Closure Head," Revision 6. Based on his review of the certified material test report and drawing for the replacement RV closure head/head flange, the inspector confirmed that the RV closure head/head flange was fabricated using SA-508, Class 3 forging material, which is more resistant to underclad cracking.

Based on this review, the staff finds that the intergranular separation (underclad cracking) flaw TLAA in SRP-LR Table 4.1-3 is not applicable to the flange in the new upper RV closure head and does not need to be identified as a TLAA for the following reasons:

- The analyses are only applicable to forgings designed to SA-508, Class 2 specifications.
- The flange for the new upper RV closure head is designed and fabricated from specification requirements (i.e., SA-508, Class 3 specification requirements), which make the material more resistant to the effect of RV underclad cracking.

For the remainder of the RV shell, the staff reviewed the applicant's TLAA, consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state that the "documented results of the revised analyses are reviewed to verify that their period of evaluation is extended, such that they are valid for the period of extended operation (e.g., 60 years)." The staff also assessed the applicant's criteria against the staff's recommended position and criteria on RV underclad cracking in RG 1.43, "Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components," May 1973.

Intergranular cracking in the HAZ of low-alloy steel RV forgings underneath stainless steel welded cladding (i.e., underclad cracking) has been observed for specific materials and cladding process conditions. In accordance with RG 1.43, underclad cracking has been reported only in SA-508, Class 2 RV forgings manufactured to a coarse-grain practice when clad using "high-heat-input" submerged arc welding processes. Cracking has not been observed in SA-508, Class 2 materials clad using "low-heat-input" processes, which are controlled to minimize heating of the base metal.

All SA-508, Class 2 RV beltline forgings at Davis-Besse are deemed potentially susceptible to underclad cracking because these forgings are manufactured to a coarse grain practice and clad using "high-heat-input" submerged arc welding processes. The applicant stated that a plant-specific fracture mechanics analysis of the susceptible RV forgings was performed for 60 years of facility operation. This analysis was based on 52 EFPY fracture toughness parameters; applied stress intensity factor solutions for normal, upset, emergency, and faulted conditions; and SA-508, Class 2 fatigue crack growth correlations based on 60-year projected cycles for the period of extended operation. The applicant performed the analysis for the limiting RV beltline region and the nozzle belt region.

The staff-approved BAW-2274, "Fracture Mechanics Analysis of Postulated Underclad Cracks in B&W Designed Reactor Vessels for the Period of Extended Operation," December 1996, in

Appendix C of its final SE for BAW-2251. BAW-2274 updated the BAW-10013 underclad cracking analysis for license renewal considerations. The staff approved referencing of both BAW-2251-A and BAW-2274 in LRAs by letter dated April 26, 1999. In Appendix C of its final SE for BAW-2251, the staff concluded that the B&WOG methodology for flaw evaluations of postulated underclad cracks for the period of extended operation, as described in BAW-2274, is consistent with the current well-established flaw evaluation procedure and acceptance criteria in the ASME Code, Section XI, IWB-3612; therefore, it is adequate. The additional conservatism associated with the B&WOG methodology includes the following:

- using the maximum crack depth of 0.165 in. reported by the industry as the initial crack depth instead of the depth of 0.10 in. reported on the B&W RVs
- assuming all underclad cracks are surface cracks
- using the fatigue crack growth rate for surface flaws in a water reactor environment
- producing results equivalent to a safety factor 17 percent more than that specified by the ASME Code, Section XI, IWB-3612 acceptance criteria for Service Level A and B loading and 72 percent more than that specified by IWB-3612 for Service Level C and D loading

The staff noted that, as stated in LRA Section 4.2.6, the plant-specific underclad cracking analysis was consistent with the NRC-approved methods for B&W plants, with the exception of the applicant's assumed initial axial flaw depth of 0.353 in. and flaw length of 2.12 in. These initial flaw dimensions are more than twice as large as the largest detected underclad flaws used as the basis for the BAW-2274 report. Therefore, the applicant's assumed initial flaw dimensions ensure that the plant-specific analysis is based on a conservative assumption.

The applicant reported that the results of the 60-year plant-specific analysis indicated that the postulated underclad axial flaws remain in compliance with the acceptance criteria specified in IWB-3612 through the period of extended operation for Service Levels A, B, C and D, accounting for fatigue crack growth through 60 years. LRA Section 4.2.6 states that axially-oriented underclad flaws located in the thickness transition at the lower end of the nozzle belt region were determined to be the most bounding due to the stress intensity factor solutions for these flaws at this location in the RV.

The applicant applied the maximum stress intensity factors for normal/upset and emergency/faulted conditions to determine the minimum acceptable fracture toughness values, in accordance with the acceptance criteria of IWB-3612. For both sets of conditions, the applicant determined that the actual material fracture toughness exceeded the minimum fracture toughness requirements at the end of the period of extended operation. Accordingly, the applicant concluded, in LRA Section 4.2.6, that the postulated underclad cracks in the Davis-Besse RV are acceptable for continued operation through the period of extended operation.

Based on its review of the applicant's evaluation of its RV forging underclad cracking TLAA, as documented above, the staff determined that the applicant described its underclad cracking analysis in sufficient detail and, therefore, adequately demonstrated that the underclad cracking satisfied the flaw analytical acceptance criteria in IWB-3612 for the period of extended operation. Furthermore, the staff found that the applicant's description of the plant-specific 60-year analysis of the postulated underclad cracks is consistent with the methodologies used in BAW-2274, with the exception that a more conservative initial flaw size was used in the plant-specific analysis. However, since the document for the 60-year plant-specific analysis of underclad cracking is not in the list of references provided in LRA Section 4.8, the staff requested this reference by letter dated March 17, 2011, in RAI 4.2.6-1.

In its response dated April 15, 2011, the applicant provided a non-proprietary version of the plant-specific report, AREVA Document 86-910440-000, “Fracture Mechanics Analysis of Postulated Underclad Cracks in the DB-1 Reactor Vessel for 60 Years,” July 2010. The staff reviewed the report and found the fracture mechanics analysis of the postulated underclad cracks documented in the AREVA report to be acceptable, and consistent with LRA Section 4.2.6. The staff’s concern described in RAI 4.2.6-1 is resolved.

Based on its evaluation of the applicant’s plant-specific 60-year analysis of postulated underclad cracking in the SA-508, Class 2 RV forgings at Davis-Besse, including its response to RAI 4.2.6-1, the staff found that the underclad cracking TLAA has been projected to meet the ASME Code, Section XI, IWB-3612, flaw evaluation analytical acceptance criteria for Levels A, B, C, and D service loadings through the period of extended operation.

Based on its evaluation, as discussed above, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of RV forging underclad cracking has been projected to the end of the period of extended operation. Additionally, the staff finds that the applicant’s TLAA meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the analysis of RV forging underclad cracking has been projected to the end of the period of extended operation.

4.2.6.3 USAR Supplement

LRA Section A.2.2.6 provides the USAR supplement summary description for the RV forging underclad cracking TLAA evaluation. By letter dated March 9, 2012, the applicant provided LRA Amendment 24. This amendment, in part, revised LRA Section A.2.2.6, to indicate that (1) the RV closure head/head flange was replaced in the fall of 2011, and (2) the replacement RV closure head/head flange was fabricated using SA-508, Class 3 material, which is not susceptible to intergranular separations and underclad cracking. Based on its review of the USAR supplement, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.7.3.2.

4.2.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of RV forging underclad cracking has been projected to the end of the period of extended operation. 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), and, therefore, is acceptable.

4.2.7 Reduction in Fracture Toughness of Reactor Vessel Internals

4.2.7.1 Summary of Technical Information in the Application

LRA Section 4.2.7 describes the applicant’s TLAA for the reduction in fracture toughness of the RVI. The applicant cited USAR Appendix 4A, which describes the detailed stress analysis of the internals under accident conditions for the current term of operation. According to the applicant, the analysis shows that the internals will not fail because the stresses are within established limits. The applicant stated that the effect of irradiation on the mechanical properties and deformation limits for the RVI was also evaluated for the current term of operation. The applicant also stated that the aforementioned analysis concluded that the RVI will have adequate ductility to absorb local strain at the regions of maximum stress intensity and that irradiation will not adversely affect deformation limits.

The applicant stated that the impact of the MUR power uprate on the structural integrity of the RVI components was evaluated. The applicant concluded that the temperature changes due to the MUR power uprate are bounded by those used in the existing analyses. As part of the MUR power uprate, the applicant stated that, "[a]s appropriate, FENOC commits to incorporate recommendations from MRP [Materials Reliability Program] inspection guidelines into the RVI program at Davis-Besse Nuclear Power Station, Unit, No. 1."

The applicant stated that this TLAA will be managed during the period of extended operation through the implementation of the PWR RVI Program.

Based on the information above, the applicant concluded that the effects of neutron embrittlement on the reduction in fracture toughness for the RVI will be appropriately managed during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.7.2 Staff Evaluation

The staff reviewed LRA Section 4.2.7 on the reduction in fracture toughness for the RVI to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of neutron embrittlement on the RVI will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant shall propose to manage the aging effects associated with the TLAA using an AMP in the same manner as described in the IPA in 10 CFR 54.21(a)(3). SRP-LR Section 4.7.3.1.3 also states that the applicable AMP is reviewed to verify that the effects of aging on the intended functions are adequately managed, consistent with the CLB for the period of extended operation.

Exposure of stainless steel RVI components to high-energy neutron radiation during the period of extended operation could result in a significant reduction in fracture toughness, depending on the material, irradiation temperature, and neutron fluence.

The staff determined that the reduction in fracture toughness of the stainless steel RVI is a TLAA that should be managed during the period of extended operation. The staff reviewed LRA Section 4.2.7 to determine if the applicant's TLAA of the reduction in fracture toughness for the RVI demonstrates that the effects of embrittlement on these components will be adequately managed during the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(iii). The applicant appropriately referenced the Davis-Besse PWR RVI Program for managing the loss of fracture toughness for the stainless steel RVI components. The staff reviewed the Davis-Besse PWR RVI Program, as described in LRA Section B.2.32, and amended through LRA Amendment 15, and confirmed that it manages loss of fracture toughness due to neutron embrittlement of RVI components. The staff's review of the Davis-Besse PWR RVI Program is provided in SER Section 3.0.3.3.6.

The staff noted that cast austenitic stainless steel (CASS) components are susceptible to thermal embrittlement in addition to neutron embrittlement. As such, the reduction in fracture toughness for CASS RVI components should account for the effects of both neutron embrittlement and thermal embrittlement. The staff noted that LRA Aging Management Review (AMR) Results for the RVI (LRA Table 3.1.2-2) list many CASS RVI components. By letter dated March 17, 2011, the staff issued RAI 4.2.7-1 requesting that the applicant discuss how the effects of thermal embrittlement will be addressed for managing the reduction in fracture toughness for the CASS RVI components, with respect to thermal embrittlement susceptibility screening, supplemental examinations of CASS components, and component-specific evaluations of reduction in fracture toughness for the susceptible CASS RVI components under the Davis-Besse PWR RVI Program.

In its April 15, 2011, response to RAI 4.2.7-1, the applicant stated that the screening of the CASS RVI components and component-specific evaluations of the reduction in fracture toughness due to neutron embrittlement and thermal aging was performed as part of the development of the EPRI MRP PWR RVI inspection and evaluation guidelines.

These guidelines are documented in EPRI MRP Topical Report No. 1016596 (MRP-227), Revision 0, “Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines,” January 2009. The staff noted that the NRC-approved version of the MRP-227 report, MRP-227-A, includes the staff’s December 2011 final SE on MRP-227 as an attachment. The MRP-227-A report provides inspection and evaluation guidelines acceptable to the staff for implementation in plant-specific PWR internals programs. The Davis-Besse PWR RVI Program, as amended, is based on the MRP-227 inspection and evaluation guidelines. As an input document to MRP-227, the MRP-189 report (EPRI Report No. 1018292, “Materials Reliability Program: Screening, Categorization, and Ranking of B&W-Designed PWR Internals Component Items (MRP-189, Revision 1),” March 2009 (Agencywide Document Access and Management (ADAMS) Accession No. ML091671777)) performed screening of the CASS RVI components and included ferrite and molybdenum content in the parameters screened. LRA Table 3.1.2-2 lists four RVI component types made from CASS, for which reduction in fracture toughness is managed under the PWR RVI Program.

The staff found the applicant’s response to RAI 4.2.7-1 acceptable because the screening of CASS RVI components to determine susceptibility to thermal aging is performed in accordance with MRP-227, and component-specific evaluations of reduction in fracture toughness due to both neutron embrittlement and thermal embrittlement were performed as part of the development of MRP-227 for the CASS RVI components listed in LRA Table 3.1.2-2. In addition, the staff’s concern with appropriate management of fracture toughness reduction for CASS RVI components will be addressed by the applicant through implementation of its PWR RVI Program. Therefore, the staff’s concern described in RAI 4.2.7-1 is resolved.

The staff noted that applicant’s proposal to implement MRP-227 as the basis for its plant-specific PWR RVI Program must address all of the plant-specific and vendor-specific action items associated with plant-specific implementation of MRP-227, as specified in Section 4.2 of the staff’s SE on MRP-227. The staff’s evaluation of the PWR RVI Program is provided in SER Section 3.0.3.3.6.

Based on the above evaluation, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the fracture toughness of the RVI will be adequately managed by the PWR RVI Program for the period of extended operation. Additionally, the staff finds that the applicant’s TLAA meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the effects of aging on the intended function will be adequately managed for the period of extended operation.

4.2.7.3 USAR Supplement

LRA Section A.2.2.7 provides the USAR supplement summary description for the reduction in fracture toughness of the RVI TLAA evaluation. Based on its review of the USAR supplement, the staff concludes that the information in the USAR supplement is an adequate summary description of the evaluation, as required by 10 CFR 54.21(d), and is consistent with SRP-LR Section 4.7.3.2.

4.2.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the RVI will be adequately managed for the period of extended operation. 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), and, therefore, is acceptable.

4.3 Metal Fatigue

LRA Section 4.3 provides the assessment of metal fatigue as a TLAA for Davis-Besse license renewal. The applicant's assessment is documented in the following major subsections of LRA Section 4.3:

- LRA Section 4.3.1—describes significant characteristics of fatigue cycles and the monitoring activities performed by the applicant's Fatigue Monitoring Program.
- LRA Section 4.3.2—Class 1 vessels, pumps, and major components (in 4.3.2.2) and Class 1 piping and valves (in 4.3.2.3)
- LRA Section 4.3.3—non-Class 1 piping and in-line components (in 4.3.3.1) and non-Class 1 major components (in 4.3.3.2)
- LRA Section 4.3.4—effects of reactor coolant environment on fatigue

The staff's evaluation of LRA Section 4.3.1 is documented in SER Section 4.3.1.2 below. The description and staff's evaluation of above listed Sections 4.3.2, 4.3.3, and 4.3.4 are documented in SER Sections 4.3.2, 4.3.3, and 4.3.4, respectively.

4.3.1 Fatigue Cycles

4.3.1.1 Summary of Technical Information in the Application

LRA Section 4.3.1 describes the design transients and associated number of design cycles that are significant fatigue contributors in the applicant's assessment of fatigue TLAAs. The applicant stated that its ASME Code Class 1 components are designed for cyclic loads due to temperature and pressure changes in the RCS, expected from normal unit load transients, reactor trips, startup and shutdown operations, and earthquakes. USAR Table 5.1-8 lists the 14 original design transients for the RCS; however, over the life of the plant, additional transients were identified, including analyzed transients for new components and non-RCS components. As an example, in evaluating its response to NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," the applicant redefined the HU/CD transients. These redefined transients, and other transients modified to include thermal stratification and striping, were provided in LRA Table 4.3-1 along with the 14 original design transients.

The number of design cycles and 60-year projections for these transients are provided in LRA Table 4.3-1. These projections were obtained by first compiling the number of cycles accrued from plant startup until February 2008 and, then, linearly extrapolating to 60 years of operation. When the projected cycles were compared with the number of design cycles in LRA Table 4.3-1, transients 9C, 9D, and 32 were the only transients affecting Class 1 components for which the 60-year projected cycles exceeded the design cycles. The applicant provided further discussion of these transients and stated that, since the components affected by these transients may be reanalyzed for other reasons, it will manage fatigue of these components for the period of extended operation rather than reanalyze for the possible additional cycles. The applicant also stated that its Fatigue Monitoring Program manages metal fatigue by monitoring the cycles incurred and assures that corrective action will be taken prior to any analyzed numbers of events being exceeded.

4.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1 to verify that the design transients (original and modified), which are significant fatigue contributors, are monitored to ensure that the applicant's design basis fatigue evaluations remain valid. The staff also reviewed the methodology used by the applicant to obtain the 60-year projections. TS Section 5.5.5, "Allowable Operating Transient Cycles Program," (AOTC) requires controls to track the cyclic and transient occurrences provided in USAR Section 5 and USAR Table 5.1-8 to ensure that components are maintained within the design limits. The staff's review of the Fatigue Monitoring Program, which includes the AOTC monitoring activities, is documented in SER Section 3.0.3.2.6.

During its review of the Fatigue Monitoring Program, the staff was not able to verify which transients are monitored and are considered fatigue-significant because there were several differences in various transient descriptions and cycle counts between LRA Table 4.3-1, the AOTC procedure, and USAR Table 5.1-8. By letter dated April 20, 2011, the staff issued RAI B.2.16-1 requesting that the applicant clarify and justify the discrepancies between the program implementation procedure, USAR Table 5.1-8, and LRA Table 4.3-1. The staff's evaluation of the applicant's response to RAI B.2.16-1 is documented in SER Section 3.0.3.2.6.

The staff noted that USAR Table 5.1-8 includes the classification of transients by the plant condition (normal, upset, etc.); however, LRA Table 4.3-1 includes several transients that are not listed in the USAR, along with the classification of the transient. LRA Section 4.3.2.2 states that cumulative usage factors (CUFs) for the Class 1 components are calculated based on normal and upset design transient definitions contained in the component design specifications. However, the staff noted that transient 9, "Rapid Depressurization," is classified as "Emergency" in USAR Table 5.1-8. Therefore, it is not clear if LRA Table 4.3-1 includes all emergency transients that were used in the fatigue analyses. By letter dated May 2, 2011, the staff issued RAI 4.3-1, Request 1, asking the applicant to clarify whether all fatigue significant transients in the fatigue TLAAs have been listed in LRA Table 4.3-1 and to identify the plant condition for each transient. The staff also requested in Request 2 that the applicant confirm whether the design basis fatigue evaluations included emergency and test conditions in addition to the normal and upset conditions.

In its response to Request 1, dated June 17, 2011, the applicant stated that LRA Table 4.3-1 includes all fatigue significant transients that are included in the metal fatigue TLAAs. Furthermore, these transients are consistent with the applicant's AOTC procedure and RCS functional specification, which is the primary source of design transients for the B&W-supplied RCS components. The staff noted that LRA Table 4.3-1 was previously amended in response to RAI B.2.16-1 by letter dated June 3, 2011. The staff's review of the applicant's response to RAI B.2.16-1 is documented in SER Section 3.0.3.2.6.

The staff finds the applicant's response to Request 1 of RAI 4.3-1 acceptable because the applicant confirmed that all fatigue significant transients included in its metal fatigue TLAAs are captured in amended LRA Table 4.3-1. These transients are incorporated into the applicant's Fatigue Monitoring Program, which ensures that the component fatigue usage does not exceed the design limit during the period of extended operation.

In its response to RAI 4.3-1, Request 2, dated June 17, 2011, the applicant stated that, from its review of the design report summaries for RCS components, the fatigue analyses include test transients, normal and upset transients, and operational basis earthquakes. The applicant also stated that the only CUF that included an emergency event was for the RV studs where the design CUF of 0.70 was conservatively increased by 0.026 to include 20 natural circulation cooldown events. The applicant stated that the incremental fatigue due to the emergency event is not required by ASME Code, Section III, Subsection NB-3224.5, and it amended LRA Section 4.3.2.2 to more accurately reflect the ASME Code Section III requirements.

The staff finds the applicant's response to Request 2 of RAI 4.3-1 acceptable because the applicant confirmed that test transients, normal and upset transients, and operational basis earthquakes are included in the metal fatigue TLAAs, which are tracked by the applicant's Fatigue Monitoring Program, and the analysis for the RV studs were the only components that included an emergency event. The staff's concerns described in RAI 4.3-1, Requests 1 and 2, are resolved.

LRA Table 4.3-1 states that transients 19, 20A, 20B, 20C, 23A, 23B, 23C, and 23D are not fatigue significant events, and transients 25A and 25B are not fatigue events; therefore, the applicant determined that the monitoring of these transients is not needed. However, the staff did not find a basis in the LRA to explain why these transients are not fatigue contributors and do not need to be monitored. By letter dated May 2, 2011, the staff issued RAI 4.3-10 requesting that the applicant justify why these transients are not considered fatigue significant events and why these transients do not need to be monitored by the Fatigue Monitoring Program during the period of extended operation.

In its response dated June 17, 2011, the applicant stated that the transients from LRA Table 4.3-1 do not need to be counted under the cycle-counting activities of its Fatigue Monitoring Program, as described below.

The applicant clarified that transient 19, "Feed and Bleed operation," occurs when RCS boron concentration is changed by introducing borated or deborated water through the makeup system. The stress analysis for the makeup nozzle was reviewed by the applicant, which indicated that transient 19 does not have any fatigue contribution. The applicant stated that the expected cycles for transient 20, "Makeup and Pressurizer Spray transients," are low compared to the large number of design cycles; therefore, transient 20 has very little impact on fatigue. Transient 23, "Steam Generator Filling, Draining, Flushing, and Cleaning," occurs at temperatures less than 225 °F; therefore, the applicant determined that little or no contribution to fatigue of the steam generators (SGs) is expected. Transient 25, "Pressurizer Heaters," is only applicable to the electrical heaters; therefore, the applicant determined that there is no contribution to fatigue of the pressurizer or pressurizer heater elements

The staff finds the applicant's basis for not monitoring transient 19 acceptable because the stress analysis confirmed that the contribution to fatigue is insignificant to the CUF value. The staff also noted that in order for the applicant to reach the cycle limit for the transient 20C it must occur once a day for 60 years without considering RFOs. Similarly, the staff noted that transients 20A and 20B must occur approximately 183 and 1.4 cycles, respectively, per day for 60 years, without considering RFOs, in order to reach the cycle limit. The staff reviewed the applicant's USAR and noted that the pressurizer spray system and makeup system operate in conjunction to accommodate changes in the reactor coolant volume due to small temperature changes. Therefore, the staff finds it reasonable that the applicant does not monitor transient 20 because the design cycles are large compared to the number of expected cycles and small temperature changes will not result in significant accumulation of fatigue usage. The staff finds the applicant's basis for not monitoring the transient 23 from LRA Table 4.3-1 acceptable because the components affected by this transient remain below the temperature threshold of 225 °F; therefore, the cyclic fluctuation in temperatures is not substantial enough to cause a significant impact to the CUF of SG components. The staff finds the applicant's basis for not monitoring transient 25 acceptable because this transient is only applicable to the electrical heaters and is not applicable to those components in the pressurizer with a CUF value.

The staff finds the applicant's response acceptable because the applicant is monitoring all transients that cause cyclic strain that are significant contributors to the fatigue usage factor that have been included in the applicant's design basis fatigue evaluations, consistent with the recommendations in the GALL Report AMP X.M1. Further, the applicant justified not monitoring select transients, as described above, and the staff found these justifications acceptable. The staff's concern described in RAI 4.3-10 is resolved.

LRA Table 4.3-1 indicated that transient 22A, "Test-High Pressure Injection System," corresponds to transient 12 in USAR Table 5.1-8 and transient 3, "Power change 8-100%," and transient 4, "Power change 100-8%," correspond to transient 3 in USAR Table 5.1-8. The applicant provided technical justifications for not monitoring these transients in its Fatigue Monitoring Program in LRA Table 4.3-1. However, the staff noted that TS 5.5.5 requires cycle counting of the applicant's design basis transients in USAR Table 5.1-8, unless the USAR specifically explains why monitoring is not required. The staff noted that the Revision 26 of USAR Table 5.1-8 indicates that these transients are applicable to TS 5.5.5 and are not excluded from monitoring. By letter dated May 2, 2011, the staff issued RAI 4.3-11 requesting that the applicant confirm that the "Test-High Pressure Injection System," "Power change 8-100%," and "Power change 100-8%" transients are the only transients in LRA Table 4.3-1 and USAR Table 5.1-8 that require counting per TS 5.5.5 but are not counted by the Fatigue Monitoring Program. If not, the staff asked the applicant to identify any additional transients that require counting per TS 5.5.5 but are not counted by the Fatigue Monitoring Program. The staff also asked the applicant to clarify whether USAR Table 5.1-8 and TS 5.5.5 currently do not require these transients to be monitored and to justify why these transients can be omitted from monitoring without justification in the USAR and the applicant's cycle-counting procedure.

In its response dated June 17, 2011, the applicant stated that a response was previously provided in letter dated June 3, 2011, in response to RAI B.2.16-1, to address whether USAR Table 5.1-8 currently required the three aforementioned transients to be monitored. The staff noted that the applicant will update USAR Table 5.1-8, which is part of the applicant's CLB and provide the technical justification as to why the monitoring of these transients can be omitted. LRA Table 4.3-1, as amended by letter dated June 3, 2011, states the "Power change 8-100%" and "Power change 100-8%" transients could not credibly approach the large number of design cycles during the period of extended operation because the plant is not a load following plant. The staff noted that power changes at a base-loaded plant are normally the result of RFOs, maintenance, post-reactor trip startups, or TS action statements. Since there is a large number of design cycles for these two transients and the power changes at the applicant's plant are not the result of load following, the staff finds it reasonable that these two transients are not monitored by the Fatigue Monitoring Program. The staff's evaluation of RAI 4.3-2 discusses the basis that the "Test-High Pressure Injection System" transient can be omitted from monitoring by the Fatigue Monitoring Program. The staff's review of RAI B.2.16-1 is documented in SER Section 3.0.3.2.6.

The staff finds the applicant's response acceptable because, with the revision of USAR Table 5.1-8 to provide the technical justifications for not monitoring these transients, the applicant ensured that its CLB accurately reflects the transients that are monitored by the Fatigue Monitoring Program. The staff's concern described in RAI 4.3-11 is resolved.

In its review of LRA Section 4.3.1.2, "Projected Cycles," the staff noted that the elbowlets in HPI nozzles 1-1 and 1-2 were limited to 13 cycles of transients 9A, "Rapid RCS Depressurization 1-1," and 9B, "Rapid RCS Depressurization 1-2." The current cycles are 9 and 8 for HPI nozzles 1-1 and 1-2, respectively. During its audit, the staff noted discrepancies in the cycle count for transient 8, "Rapid Depressurization," of USAR Table 5.1-8, as described in the applicant's Fatigue Monitoring Program (AOTC procedure) logs. In the AOTC log, dated February 1990, a total of 11 cycles were recorded for this transient, out of the design limit of 13. In addition, the AOTC log, dated March 2003, stated that a total of 9 cycles were recorded for this transient, out of the design limit of 13. By letter dated May 2, 2011, the staff issued RAI 4.3-2, Request 1, asking the applicant to describe and justify the discrepancy between cycle counts for transients 9A–9D in LRA Table 4.3-1 and the AOTC logs dated February 1990 and March 2003. The staff also requested in, Request 2, that the applicant clarify whether corrective actions were taken, based on the cycle count exceeding the applicant's 75 percent action limit. Finally, the applicant was asked, in Request 3, to identify the design transients and associated cycle limits that were used in the design basis fatigue evaluations of the HPI nozzles and elbowlets.

In its response to Request 1 of RAI 4.3-2, dated June 17, 2011, the applicant stated that, during the review of the AOTC program as part of the Cycle 13 RFO (ended March 27, 2004) restart effort, the AOTC status log was updated. This updated status log included the latest transient 9 (now transient 22 A2) cycle counts and limits (13-cycle limit for train 1 and 40-cycle limit for train 2) based on that review. In addition, the number of cycles for the individual nozzles were separated starting with this updated status log and, as a result of the review and update, the event counts as of May 22, 2003, were as follows:

- 9 cycles for HPI nozzle 1-1
- 8 cycles for HPI nozzle 1-2
- 20 cycles for HPI nozzle 2-1
- 15 cycles for HPI nozzle 2-2

The staff finds the applicant's response to Request 1 acceptable because the applicant clarified the discrepancy by explaining that, prior to May 22, 2003, the event cycles for each HPI nozzle were not documented individually in the AOTC status log. The applicant confirmed the cycle counts, as listed above, for each HPI nozzle from its review of the event logs.

In its response to Request 2 of RAI 4.3-2, dated June 17, 2011, the applicant stated that the February 19, 1990, AOTC status log showed a total of 11 events for transient 9 (now transient 22 A2). The applicant reviewed the AOTC event logs up to that date and confirmed that 11 cycles were logged for nozzle 2-1, 2 cycles were logged for nozzle 2-2, 3 cycles were logged for nozzle 1-1, and 2 cycles were logged for nozzle 1-2. The staff noted that the cycle counts for the train 2 nozzles (2-1 and 2-2) cycle counts were below the 40-cycle limit, and the train 1 nozzles (1-1 and 1-2) were also below the 13-cycle limit. The applicant stated that these transient cycle counts did not exceed the 75 percent action limit.

The staff finds the applicant's response to Request 2 of RAI 4.3-2 acceptable because the applicant's review of the event logs confirmed that the transient cycle counts for the train 1 and train 2 HPI nozzles never exceeded the 75 percent action limit; therefore, no corrective actions were needed.

In its response to Request 3 of RAI 4.3-2, dated June 17, 2011, the applicant stated the objective of transient 9 (now transient 9A) in LRA Table 4.3-1 is to isolate a SG tube leak and results in the actuation of HPI. This is the only upset event in the RCS functional specification that results in HPI actuation. The applicant stated that the design cycle limit for this transient is 40. The applicant also stated that the 40-cycle limit was reduced to 13 (for HPI lines 1-1 and 1-2 with the elbowlets as the limiting location) in 1983 by a Bechtel evaluation of the HPI lines in response to IEB 79-14, and HPI lines 2-1 and 2-2 were qualified for 40 cycles.

The applicant clarified that transient 22 (now transient 22 A1), "HPI System Test," is the only other transient in the RCS functional specification that results in HPI actuation. The applicant stated that this test, as defined in the RCS functional specification, includes HPI flow through all four HPI nozzles for 10 seconds with RCS pressure of 2,200 psig and RCS temperature of 550 °F. However, the staff noted that since the HPI pump shutoff head at the applicant's site is approximately 1,600 psig, which is less than the RCS pressure of 2,000 psig, the flow from this test never comes into contact with the four HPI nozzles, and the HPI pump recirculates back to the BWST. The applicant stated that no inventory is added to the RCS for its plant configuration, and transient 22 (now transient 22 A1) is not applicable but is conservatively included in the design basis fatigue evaluations of the HPI nozzles and HPI elbowlets. The staff finds is reasonable that this test transient is not monitored by the applicant's Fatigue Monitoring Program, based on its plant-specific configuration, because the HPI flow from transient 22 A1 does not come into contact with the four HPI nozzles to create a temperature differential. Therefore, there is no contribution to fatigue usage on the four HPI nozzles from this test transient.

The applicant clarified that, in 1987, it initiated a test transient entitled, "HPI System Pressure Isolation Integrity Test-Back-to-Back Check Valves," which isolates makeup flow to the HPI nozzle used for reactor makeup with RCS pressure and temperature at 2,155 psig and 532 °F, respectively, for approximately 15 minutes and then resumed. The applicant clarified that the purpose of the test is to ensure that the HPI/makeup check valves work properly and isolate the HPI/makeup system from the RCS. This test did not fit the RCS functional specification definitions for transient 9 (now transient 9A) or transient 22 (now transient 22 A1) and was considered a new transient with the number of test cycles defined as 40. The staff noted that these new transients were included as transients 9A–9D (now transient 22 A2 for each of the HPI nozzles) in the applicant's Fatigue Monitoring Program.

The staff finds the applicant's response to RAI 4.3-2, Request 3, acceptable because the applicant monitors all transients that are applicable to the design basis fatigue evaluations of the HPI nozzles and elbowlets with its Fatigue Monitoring Program, with the exception of transient 22 A1 as described above, to ensure that the CUF, including environmental effects, as applicable, does not exceed the 1.0 design limit. Additionally, the applicant conservatively assumed the occurrence of transient 22 A1 in its design basis fatigue evaluation even though the test transient is not applicable to its plant. The staff's concerns described in RAI 4.3-2 are resolved.

LRA Section 4.3.1.2 states that "transients 9C, 9D, and 32 are the only transients affecting Class 1 components where the 60-year projected cycles exceed the design cycles." It was not clear to the staff if there are components, other than HPI nozzles 2-1 and 2-2, which are limited to 40 cycles of transients 9C and 9D, respectively, in the design basis fatigue evaluations and whether these components will be affected if the 60-year projected cycles are exceeded. By letter dated May 2, 2011, the staff issued RAI 4.3-15 requesting that the applicant clarify if there are other components that consider transients 9C or 9D in the design basis fatigue evaluations and to identify the number of design cycles in those evaluations, along with the associated justification for the disposition of the fatigue TLAA for these components.

In its response dated June 17, 2011, the applicant stated that transients 9C (now transient 22 A2, HPI nozzle 2-1) and 9D (now transient 22 A2, HPI nozzle 2-2) are only applicable to HPI nozzles 2-1 and 2-2, respectively. The applicant clarified that by letter dated June 3, 2011, in the response to RAI B.2.16-1, it amended LRA Table 4.3-1 such that the previously listed transients of 9A–9D are renamed as the HPI system pressure isolation integrity tests and are now grouped under transient 22 A2 (HPI nozzles 1-1, 1-2, 2-1, and 2-2). The staff's review of RAI B.2.16-1 is documented in SER Section 3.0.3.2.6.

The staff finds the applicant's response acceptable because the applicant confirmed that the only components affected by transients 9C (now transient 22 A2, HPI nozzle 2-1) and 9D (now transient 22 A2, HPI nozzle 2-2) are HPI nozzles 2-1 and 2-2, respectively. The applicant's Fatigue Monitoring Program counts these transient cycles to ensure the allowable cycle limits used in the design basis fatigue evaluations are not exceeded. The staff's concern described in RAI 4.3-15 is resolved.

LRA Section 4.3.1.2 indicates that the number of cycles accrued as of February 2008 were compiled and linearly extrapolated to the 60 years of operation to determine whether the incurred cycles would remain below the number of design cycles. However, the applicant did not justify the use of a linear extrapolation to determine the number of cycles for 60 years and whether it is conservative, based on its plant-specific operating history. By letter dated May 2, 2011, the staff issued RAI 4.3-9 requesting that the applicant explain the methodology used for the linear extrapolation of design transient cycle counts and to justify that its use is valid and conservative, based on the plant-specific operating history.

In its response dated June 17, 2011, the applicant stated that, based on its plant-specific operating history, transient occurrences were frequent early in plant life and, as issues were resolved, the transient frequency at the plant decreased. The applicant added that its fuel cycle has been increased to 2 years in duration, which results in further decreases in transient cycles. Therefore, the applicant determined that linear extrapolation of cycles, based on the entire operating history of the plant, to project 60-year cycles is conservative. The applicant provided an example of its projection methodology for the plant heat-up transient in its response to the RAI. The staff noted that this example demonstrated that the rate of occurrence based on recent plant-specific operating history is less than the projected rate of occurrence assumed by the applicant. The staff finds the use of this linear extrapolation conservative because the applicant considered the time period when it experienced frequent transient occurrences into its extrapolation and did not only consider its recent improved operating history.

The staff finds the applicant's response acceptable because the applicant considered operating history early in plant life into its projection methodology and demonstrated that its projection methodology is conservative. The applicant's Fatigue Monitoring Program counts transient cycles to ensure allowable cycle limits used in the fatigue analyses are not exceeded. The staff's concern described in RAI 4.3-9 is resolved.

Based on its review, the staff finds the applicant demonstrated that its projection methodology for projecting design transients to the end of the period of extended operation is conservative. The applicant will monitor all transients, that cause cyclic strains which are significant contributors to the fatigue usage factor, with its Fatigue Monitoring Program, such that corrective actions are taken prior to the design limit exceeding 1.0, including environmental effects when applicable.

4.3.1.3 USAR Supplement

LRA Sections A.2.3.1, A.2.3.1.1, A.2.3.1.2, and A.2.3.1.3 provide the USAR supplement summarizing the applicant's Class 1 Code fatigue requirements and 60-year projections of the transients that will be monitored by the Fatigue Monitoring Program. The staff reviewed LRA Section A.2.3.1 consistent with the review procedures in SRP-LR Section 4.3.3.3, which state that the reviewer should verify that the applicant has provided information to be included in the USAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the USAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.3. Additionally, the staff determines that the applicant provided an adequate summary description for the 60-year projections of the transients that will be monitored under its Fatigue Monitoring Program, as required by 10 CFR 54.21(d).

4.3.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an adequate description and acceptable basis for monitoring design transients and cycles with its Fatigue Monitoring Program, which are also consistent with the CLB and the design basis fatigue evaluations. Also, the staff concludes that the applicant provided an acceptable cycle projection basis for the design transients in LRA Table 4.3-1, "60-Year Projected Cycles," and provided action limits that ensure corrective actions are taken prior to exceeding the design limit during the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the cycle projection bases of transients and design cycles, as required by 10 CFR 54.21(d).

4.3.2 Class 1 Fatigue

LRA Section 4.3.2 provides the TLAAs for metal fatigue of Class 1 components within the scope of license renewal, in the following subsections:

- LRA Section 4.3.2.1—Class 1 background
- LRA Section 4.3.2.2—Class 1 vessels, pumps, and major components
- LRA Section 4.3.2.3—Class 1 piping and valves

4.3.2.1 Class 1 Background

4.3.2.1.1 Summary of Technical Information in the Application

The applicant stated that the primary code governing design and construction of Class 1 systems and components, as given in USAR Table 3.2-2, was the ASME Boiler and Pressure Vessel Code Section III, which required fatigue usage calculations based on applicable thermal and mechanical transient load cycles.

4.3.2.2 Class 1 Vessels, Pumps, and Major Components

4.3.2.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2.2 describes the metal fatigue TLAAs for ASME Code, Section III Class 1 vessels, pumps, and major components that include the RV, the control rod drives (CRDs), the RCPs, the pressurizer, and the SGs. The applicant stated that CUFs of Class 1 components are based on the service and test loading definitions contained in the component design specifications. The design transients used to generate the CUF are discussed in LRA Section 4.3.1.

<u>Reactor Vessel</u>. LRA Section 4.3.2.2.1 describes the fatigue analyses conducted for the RV, which was designed to Class A requirements in accordance with the 1968 edition of the ASME Code, Section III, inclusive of the 1968 summer addenda. The entire vessel assembly was analyzed for the primary and secondary stresses under both steady-state and transient operations, and the resulting fatigue analysis was performed by the original equipment manufacturer (OEM). The design CUFs for RV assembly locations were less than 1.0. The applicant's Fatigue Monitoring Program tracks the number of occurrences of design transients to ensure that action is taken before the analyzed numbers of transients are reached. The applicant dispositioned the fatigue TLAA of the RPV in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the RV will be managed for the period of extended operation by the Fatigue Monitoring Program.

<u>Reactor Vessel Internals</u>. LRA Section 4.3.2.2.2 describes the RVI components that include the plenum assembly and the core support assembly consisting of the core support shield, core barrel, lower grid, flow distributor, incore instrument guide tubes, thermal shield, and surveillance specimen holder tubes. The applicant's metal fatigue TLAAs of RVIs are summarized below:

<u>Low-Cycle Fatigue</u>. LRA Section 4.3.2.2.2.1 states that the design of the RVIs meets the stress requirements of ASME Code, Section III, but the design code did not require a fatigue analysis to be performed. The applicant stated that it performed fatigue analyses for the Alloy X-750 HTH bolts, which were designed to ASME Code, Section III, to replace the majority of the vessel internals Alloy A-286 bolts. The applicant also stated that the CUFs for the Alloy X-750 HTH replacement bolts were based on the system design transients in LRA Table 4.3-1 and were found to be less than 1.0. The upper thermal shield bolts, flow distributor bolts, and guide block bolts have not been replaced. The applicant dispositioned the low-cycle fatigue TLAA of the RVIs in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue will be managed for the period of extended operation by the Fatigue Monitoring Program.

<u>Reactor Vessel Internals and Incore Instrument Nozzles Flow-Induced Vibration</u>. LRA Section 4.3.2.2.2.2 discusses metal fatigue of RVIs and incore instrument nozzles subjected to flow-induced vibrations (FIV). The applicant stated that the FIV fatigue TLAA is based on the

endurance limit approach that established the maximum allowable stress limit for an infinite life. The applicant stated that to implement this approach to high-cycle fatigue due to FIV, it extended the ASME Code fatigue curve to 1.0E+12 cycles as the upper-bound for a 40-year design life in its original analysis. This resulted in an allowable stress limit of 20,400 pounds per square inch (psi), and the applicant further reduced this to a conservative design limit of 18,000 psi. The applicant stated that for 60-years of operation, the extrapolated fatigue curve at 1.5E+12 cycles is approximately 20,200 psi, still above the 18,000 psi that was used as the endurance limit. The applicant dispositioned the fatigue TLAA for the FIV of RVIs in accordance with 10 CFR 54.21(c)(1)(i), that the existing analysis remains valid for the period of extended operation.

Surveillance Capsule Holder Tubes Flow-Induced Vibration. LRA Section 4.3.2.2.2.3, as amended by letter dated June 17, 2011, discusses the metal fatigue analysis of the surveillance capsule holder tubes subject to FIV. The applicant stated that the original analysis for a 40-year design life resulted in a CUF of 0.00042 for the holder tubes and an additional 20 years of operations would result in a CUF of 0.00063, which remains below the Code design limit of 1.0. The applicant stated that it dispositioned the FIV fatigue TLAA for the surveillance capsule holder tubes in accordance with 10 CFR 54.21(c)(1)(ii), that the analysis has been projected to the end of the period of extended operation.

Control Rod Drive Housings Fatigue. LRA Section 4.3.2.2.3 describes the fatigue analysis for the CRD housings that act as the pressure retaining enclosures for the drive mechanisms. These housings were designed to the 1968 edition of ASME Code, Section III, inclusive of the 1970 summer addenda and the CUFs for various CRD locations, which are less than 1.0, were based on the system design transients given in LRA Table 4.3-1. The applicant stated that its Fatigue Monitoring Program tracks the incurred cycles of these design transients to ensure action is taken before reaching their design number of cycles. The applicant dispositioned the TLAA of CRD housings in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue will be managed for the period of extended operation by the Fatigue Monitoring Program.

Reactor Coolant Pump Casings Fatigue. LRA Section 4.3.2.2.4 describes the fatigue analysis for the RCP casings, which are welded into the piping system. The casings were designed to the 1968 edition of ASME Code, Section III, inclusive of the 1968 winter addenda, and the CUFs for the RCP casings, which are less than 1.0, were based on the system design transients given in LRA Table 4.3-1. The applicant stated that its Fatigue Monitoring Program tracks the incurred cycles of these design transients to ensure action is taken before reaching their design number of cycles. The applicant dispositioned the TLAA of RCP casings in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue will be managed for the period of extended operation by the Fatigue Monitoring Program.

Pressurizer Fatigue. LRA Section 4.3.2.2.5 describes the fatigue analysis for the pressurizer, which consists of a vertical cylindrical vessel connected by the surge line to the reactor outlet piping, with nozzles and heater bundle (closures) attached to the vessel. The pressurizer was designed to the 1968 edition of ASME Code, Section III, inclusive of 1968 summer addenda, and the CUFs for pressurizer locations, which are less than 1.0, were based on the system design transients given in LRA Table 4.3-1. The applicant stated that its Fatigue Monitoring Program tracks the incurred cycles of these design transients to ensure action is taken before their design number of cycles is reached. The applicant dispositioned the TLAA of pressurizer in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue will be managed for the period of extended operation by the Fatigue Monitoring Program.

Once-Through Steam Generators. LRA Section 4.3.2.2.6 states that the once-through steam generators (OTSGs) components exposed to RCS pressure are the hemispherical heads, the tubesheet, and the straight inconel tubes between the tubesheets. The applicant's metal fatigue TLAAs related to the OSTGs is separated into four parts, as summarized below.

OTSGs Fatigue. LRA Section 4.3.2.2.6.1 states that the primary (tube) and secondary (shell) sides of the OTSGs were designed to the 1968 edition of ASME Code, Section III, inclusive of 1968 summer addenda, and were analyzed for fatigue by the OEM. The CUFs for OTSGs locations, which are less than 1.0, were based on the system design transients given in LRA Table 4.3-1. The applicant stated that the SG remote weld plugs have a limited design life of 33 HU/CD cycles to maintain a fatigue usage of less than 1.0. The applicant's Fatigue Monitoring Program tracks the incurred cycles of these design transients to ensure action is taken before reaching their design number of cycles. The applicant dispositioned the TLAA for the OTSGs in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue will be managed for the period of extended operation by the Fatigue Monitoring Program.

OTSGs Tube Sleeves Fatigue. LRA Section 4.3.2.2.6.2 describes the fatigue analysis for the tube sleeves that were used to repair leaking tubes of the OTSGs. In accordance with USAR Section 5.5.2.3, the applicant stated that the SG tubes may be plugged or repaired by mechanical (rolled) sleeving; however, Section III of the ASME Code does not provide design rules for mechanically roll-expanded attachments, and theoretical stress analyses are inadequate. The applicant stated that, in accordance with provisions of Appendix II, Section 1500, of ASME Code, Section III, fatigue tests were performed to demonstrate the structural adequacy of the sleeves to withstand cyclic loadings based on the design transients. The pressure cycling tests used 360 startup cycles to bound all B&W 177 fuel assembly plants. The applicant stated that, per USAR Table 5.1-8, its design basis is 240 startups and it projected only 128 startups for 60 years of operation, as described in LRA Table 4.3-1. The applicant dispositioned the TLAA associated with fatigue testing of the OTSG tube sleeves in accordance with 10 CFR 54.21(c)(1)(i) disposition, that the analysis will remain valid for the period of extended operation.

OTSGs Auxiliary Feedwater Modification. LRA Section 4.3.2.2.6.3 describes the fatigue analysis for the repair to the OTSGs auxiliary feedwater (AFW) system. The modification was installed (in 1982) with an external header on each SG. The applicant stated that the AFW thermal sleeve stresses were also analyzed by B&W, and the analysis, performed in accordance with the requirements of the ASME Code for Class 1 components, provided a basis for demonstrating that the AFW thermal sleeve is capable of withstanding 40,000 cycles of AFW injection transients. The riser flange attachment to the SG shell was also analyzed per ASME Code requirements and was acceptable for a design life of 875 cycles of HU/CD, bolt-up and unbolt, and AFW initiations. Transients 30A and 30B in LRA Table 4.3-1, which have 60-year projections of 387 and 442 cycles, respectively, are each less than the 875 design cycles for the riser flange attachment. The applicant stated that design transients are tracked for the number of occurrences under its Fatigue Monitoring Program to ensure that action is taken before the design cycles are reached. The applicant dispositioned the TLAAs of AFW repair in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the AFW modification will be managed for the period of extended operation by the Fatigue Monitoring Program.

OTSGs Tubes and Tube Stabilizers Flow-Induced Vibration. LRA Section 4.3.2.2.6.4 describes the fatigue analysis performed for FIV of the OTSGs tubes and the tube stabilizers. The applicant stated that its latest analysis report showed the highest CUF for any existing tube configuration was 0.443 for an un-repaired tube next to the open lane, and the 60-year projected CUF value of 0.665 is acceptable. The applicant stated that the 60-year projected CUFs for the 3/8-in. tube-stabilizers, calculated using both high-cycle (FIV) and low-cycle (transients) fatigue, remains below the design limit of 1.0. The applicant dispositioned the fatigue TLAA associated with FIV of SG tubes and tube stabilizers in accordance with 10 CFR 54.21(c)(1)(ii), that the TLAAs have been projected through the period of extended operation.

4.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2.2, which consists of metal fatigue TLAAs for ASME Code Section III Class 1 vessels, pumps, and major components, to confirm, pursuant to the following and dependent on the applicant's evaluation:

- 10 CFR 54.21(c)(1)(i), that the analyses remain valid during the period of extended operation
- 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation
- 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation

Reactor Vessel. The staff reviewed LRA Section 4.3.2.2.1 on fatigue of the RV to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff noted that the LRA did not provide the CUF values for most of the ASME Code Section III Class 1 components described in LRA Section 4.3.2. Without these values, the staff could not ascertain whether the CUF values for these components exceed the allowable limit or evaluate the applicant's dispositions of these metal fatigue TLAAs, in accordance with 10 CFR 54.21(c). By letter dated May 2, 2011, the staff issued RAI 4.3-12 asking the applicant to provide the 40-year design-basis CUF values for all components or critical locations, or both, that are dispositioned in LRA Section 4.3.2.

In its response dated June 17, 2011, the applicant stated that the design (40-year) CUFs for all its Class 1 components are provided in Tables 3-1 through 3-9 of AREVA Document 51-9157140-001, "DB-1 Design CUFs and NUREG/CR-6260 Screening for License Renewal," dated June 10, 2011. The applicant provided a copy of the report as an enclosure to its June 17, 2011, letter, and the CUF values provided by the applicant in response to RAI 4.3-12 allow the staff to determine if the applicant's TLAA are appropriately dispositioned in accordance with 10 CFR 54.21(c)(1). The staff's review of the applicant's metal fatigue TLAAs and its dispositions of specific ASME Code Class 1 components are documented in SER Section 4.3.2. The staff's concern described in RAI 4.3-12 is resolved.

LRA Section 4.3.2.2.1 states that the bottom head of the RV assembly is penetrated by the instrumentation nozzles, and the design CUFs for all RV locations were calculated to be less than 1.0. During its audit, staff noted the applicant's basis documents for metal fatigue indicated the CUF values for the instrument nozzle weld locations vary from 0.0–0.323. Furthermore, LRA Section 4.3.2.2.2.3 states that the incore instrumentation nozzles were analyzed for fatigue due to FIV with the resulting CUF of 0.59 for a 40-year life and was projected to have a CUF of 0.885 for a 60-year life. LRA Section 4.3.4.2 states that the maximum design CUF for nickel-based alloy incore instrument nozzle is 0.77. It was not clear to the staff if the generic reference of "Instrument Nozzles" in the applicant's basis documents and LRA sections refer to the same location. By letter dated May 2, 2011, the staff issued RAI 4.3-4 requesting the applicant to clarify the location(s) that are being referenced by the "Instrument Nozzle" CUFs in LRA Sections 4.3.2.2.1, 4.3.2.2.2.3, and 4.3.4.2, as well as the applicant's basis documents for metal fatigue TLAAs. The staff also asked the applicant to clarify which of these locations for the instrumentation nozzle of the RV assembly support the aforementioned statement in LRA Section 4.3.2.2.1 and is considered the limiting location.

In its response dated June 17, 2011, the applicant provided a summary table that describes the documents in which instrument nozzles were discussed. The applicant stated that the discussion of instrument nozzles in LRA Section 4.3.2.2.1 is consistent with its bases documents, which only state that all vessel CUFs are less than 1.0. The CUF value of 0.59 in LRA Section 4.3.2.2.2.3 was reported in error, and the LRA was amended to provide clarification. The applicant's review of its source document revealed that the value of 0.59 was a typical value of B&W-designed plants and that the evaluation of FIV for the instrument nozzles is documented in LRA Section 4.3.2.2.2.2. The staff's evaluation of FIV for the instrument nozzles is documented elsewhere in this SER section. The applicant stated that the CUF values of 0.000 to 0.323 were reported in the RV stress report summary for the two different styles of nozzle bodies and were not discussed in the LRA since they are not the limiting locations. The staff noted that the weld between the incore instrument nozzle and RV lower head is the limiting location, which is discussed in LRA Section 4.3.4.2, and has a 40-year design CUF value of 0.770. The applicant also described how it obtained an environmentally-assisted fatigue (EAF) CUF value of 0.857 for the nozzle to vessel weld. The staff's review of the applicant's EAF evaluations is described in SER Section 4.3.4.2.

The staff finds the applicant's response acceptable because the applicant clarified the specific locations for the instrument nozzles and the associated CUF values that were referenced in the applicant's basis documents and LRA. In addition, the applicant identified the limiting location as the weld between the incore instrument nozzle and RV lower head, which has been evaluated for the effects of reactor coolant environment as a NUREG/CR-6260 location, consistent with the recommendations in SRP-LR Section 4.3.2.1.3. The staff's concern described in RAI 4.3-4 is resolved.

The staff reviewed the CUF values provided by the applicant, in Table 3-1 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011) and confirmed that the design CUF values for the Class 1 components associated with the RV are less than the design limit of 1.0. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation and initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components, consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of the RV will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The applicant's Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant's Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant's Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Reactor Vessel Internals

Low-Cycle Fatigue. The staff reviewed LRA Section 4.3.2.2.2.1 on low-cycle fatigue of the RVI to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff noted that, as discussed in LRA Section 4.3.2.2.2.1, the applicant has not replaced the upper thermal shield bolts, flow distributor bolts, or guide block bolts, and no fatigue analysis was performed for these bolts because it was not required during the original design. However, the staff noted that LRA Table 3.1.2-2, Row Nos. 42 and 110, for upper thermal shield bolts and flow distribution bolts, respectively, credit a TLAA to manage cumulative fatigue damage. It was not clear to the staff what TLAA was being referenced, since LRA Section 4.3.2.2.2.1 states that fatigue analyses were not performed for the RVIs. By letter dated May 2, 2011, the staff issued RAI 4.3-3 requesting that the applicant identify the fatigue TLAA that is being credited to manage cumulative fatigue damage of the components identified by the AMR line items in LRA Table 3.1.2-2, Row Nos. 42 and 110.

In its response dated June 17, 2011, the applicant stated that it has not replaced the upper thermal shield bolts, flow distributor bolts, or guide block bolt; therefore, a correction is required to Row Nos. 42 and 110 of LRA Table 3.1.2-2. The staff noted that the applicant amended LRA Table 3.1.2-2 to remove the AMR line items associated with stainless steel upper thermal shield bolts and flow distributor bolts exposed to borated reactor coolant that are being managed for cracking due to fatigue by a TLAA. Although these components do not have a fatigue TLAA associated with them, the staff noted that they will be managed by the applicant's PWR RVI Program for cracking during the period of extended operation. The staff finds the removal of these AMR line items acceptable because a fatigue analysis was not performed for these components; therefore, they do not have a TLAA associated with them. The staff's concern described in RAI 4.3-3 is resolved.

The staff reviewed the CUF values provided by the applicant, in Table 3-1 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011) and confirmed that the design CUF values for the RVIs are less than the design limit of 1.0. These components are the upper and lower core barrel bolts, the lower thermal shield bolts, and the bolts associated with the surveillance specimen holder tube. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation and will initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program is an acceptable approach to manage CUF values for RCPB components, consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to low-cycle fatigue analyses of the RVIs will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The applicant's Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant's Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant's Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Reactor Vessel Internals and Incore Instrumentation Nozzles Flow-Induced Vibration. The staff reviewed LRA Subsection 4.3.2.2.2.2 on FIV of the RVIs and incore instrument nozzles to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis remains valid during the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.1 which state that the operating transient experience and a list of the assumed transients used in the existing CUF calculations for the current operating term are reviewed to ensure that the number of assumed transients would not be exceeded during the period of extended operation.

The staff noted that, as discussed in LRA Section 4.3.2.2.2.2, the fatigue of RVIs and incore instrument nozzles subject to FIV is based on the endurance limit approach, which establishes the allowable stress limit for infinite fatigue life. While this approach does not produce a CUF value or use the design transients, the staff noted that the effective CUF is implicitly demonstrated to be zero, based on maintaining the stress amplitude below the endurance limit. Mandatory Appendix I of the ASME Code Section III provides design fatigue curves. However, LRA Section 4.3.2.2.2.2 states that the ASME Code fatigue curve was extended because the 60-year projection used in the vessel internals fatigue TLAA exceeded the Code design curves. It was not clear to the staff which Appendix I design curve was used by the applicant and the method of extrapolation that was used to establish the endurance limit for the 40-year analysis and the 60-year projection. By letter dated May 2, 2011, the staff issued RAI 4.3-5 requesting the applicant to clarify and justify the ASME Code Section III (Mandatory Appendix I) design curves used in the extrapolation described in LRA Section 4.3.2.2.2.2 for all the vessel internal materials subject to the FIV.

In its response dated June 17, 2011, the applicant stated that the specific curve extrapolated in the original FIV analysis was Figure I-9.2 of the 1971 edition of the ASME Code Section III. The applicant explained that for the 40-year design, the allowable stress of 20,400 psi for 1.0E+12 cycles was identified on the fatigue curve for austenitic stainless steel. The applicant stated that it conservatively assumed the endurance limit as 18,000 psi in the FIV analysis and that the maximum calculated peak stress intensity provided in the FIV analysis is 8,260 psi for the upper thermal shield support blocks.

The applicant stated that the ASME Code fatigue curve had previously been extended from 1.0 x 10E6 cycles to 1.0 x 10E12 cycles based on the curve fit for the data found in the ASME Code transactions; for license renewal, this extrapolated curve was extended from 1.0E+12 cycles (the upper bound on the number of cycles for a 40-year design life) to 1.5E+12 cycles (the upper bound on the number of cycles for a 60-year design life). The stress value corresponding to 1.5E+12 cycles on the extrapolated fatigue curve is approximately 20,200 psi. The staff confirmed that Figure I-9.2 in the Mandatory Appendix I of the 1971 ASME Code Section III is for austenitic stainless steel. The staff noted that the endurance limit of 18,000 psi is still below, and remains valid, compared to the 20,200 psi identified on the 60-year extrapolated design curve. Furthermore, the staff noted that the maximum calculated peak stress intensity of 8,260 psi remains below the endurance limit.

The staff finds the applicant’s response acceptable because the applicant’s clarification justified that the endurance limit assumed in the original FIV analysis remains valid, as demonstrated above, which implicitly demonstrates that the CUF remains zero. The staff’s concern described in RAI 4.3-5 is resolved.

Based on its review, the staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the FIV analysis of the RVIs and incore instrument nozzles remains valid during the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.1 because the endurance limit assumed in the original analysis would not be exceeded and the implicit CUF value of zero remains valid during the period of extended operation.

Surveillance Capsule Holder Tubes Flow-Induced Vibration. The staff reviewed LRA Subsection 4.3.2.2.2.3 on FIV of the surveillance capsule holder tubes to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis has been projected the period to the end of the period of extended operation.

The staff reviewed the applicant’s TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.2, which state that the revised CUF calculations are reviewed to ensure that the CUF remains less than or equal to 1.0 at the end of the period of extended operation. The staff noted that the 40-year design CUF due to flow induced vibrations of the surveillance capsule holder tubes is 0.00042, and the applicant calculated the projected 60-year CUF by multiplying 0.00042 by a factor 1.5. The staff noted that the resulting CUF of 0.00063 remains far below the design limit of 1.0. The staff finds the use of a 1.5 factor projection basis reasonable for design basis CUF values that are based on a 40-year design life for cases in which there are no planned changes to plant operations or configuration that would call into question this projection. The resultant estimated 60-year CUF value(s) provide a gauge of how much margin is available before the design limit of 1.0 is reached. The staff noted that the 40-year design CUF due to low-cycle fatigue is 0.02 for this component, which was reviewed in SER Section 4.3.2.2.2.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the surveillance capsule holder tubes FIV analysis have been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.2 because the applicant demonstrated that the projected CUF values will be less than the ASME Code, Section III, design limit of 1.0 through the period of extended operation with significant margin.

<u>Control Rod Drive Housings Fatigue</u>. The staff reviewed LRA Section 4.3.2.2.3 on fatigue of the CRD housings to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff's review of USAR Table 5.2-1 confirmed that the design code for the CRD housings is the 1968 edition of ASME Code, Section III, inclusive of the 1970 summer addenda. The staff reviewed the CUF values provided by the applicant, in Table 3-2 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011) and confirmed that the design CUF values for the Class 1 components associated with the CRD housings are less than the design limit of 1.0. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation, and it will initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of the CRD housings will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reason:

- The applicant's Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant's Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant's Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Reactor Coolant Pump Casings Fatigue. The staff reviewed LRA Section 4.3.2.2.4 on fatigue of the RCP casings to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

During its audit, the staff noted the applicant's basis documents for metal fatigue TLAAs indicated that the cooling hole ligament of the RCP cover has a CUF value of 0.56, which was calculated with an exception to the ASME Code rules. It was not clear to the staff what the exception was and whether this exception affects the applicant's disposition for the TLAA. By letter dated May 2, 2011, the staff issued RAI 4.3-6 requesting that the applicant clarify the exception used for the fatigue analysis of the cooling hole ligament of the RCP cover and justify that the exception does not affect the TLAA disposition of the RCP casing fatigue evaluation.

In its response dated June 17, 2011, the applicant stated that, during the course of evaluating thermal cracking of RCP covers in 1980s, the reanalysis of the ligament region at the cooling holes revealed stress values that were higher than those calculated in the original design report. The applicant also stated that the revised CUF for the cooling hole ligament exceeded 1.0 and, to demonstrate that the fatigue life of the cover cooling hole ligament is acceptable for the current term of operation, B&W used the vendor stress analysis and developed an alternate simplified elastic-plastic methodology for fatigue calculation. Specifically, in this methodology, a stress and fatigue analysis of the pump cover cooling hole ligament was performed in accordance with paragraph N-415 of the 1968 edition of ASME Code, Section III, with the exception that the limit on the range of primary-plus-secondary stress intensity may be waived if certain conditions were satisfied. The applicant stated that it satisfied the conditions of the exception, and the total usage factor of 0.56 was calculated in accordance with ASME Code, Section III, paragraph N-415. The applicant explained that the CUF of 0.56 included contributions of 0.41 for HU/CD transients (205 cycles), 0.09 for the combined hydrostatic tests and heatup transient (35 cycles), and approximately 0.06 for the remaining events. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in RCP casings during the period of extended operation.

The staff finds the applicant's response acceptable because all fatigue-significant transients included in the analysis are captured in LRA Table 4.3-1, and these transients are incorporated into the applicant's Fatigue Monitoring Program, which ensures that pump cover cooling hole ligament fatigue usage does not exceed the design limit during the period of extended operation. The applicant described and confirmed that it satisfied the conditions for the "exception" in paragraph N-415 of the 1968 edition of ASME Code, Section III. The staff's concern described in RAI 4.3-6 is resolved.

LRA Table 3.1.1, item 3.1.1-55, states that the aging of these pump casings will be managed by the applicant's ISI Program and invokes the use of ASME Code Case N-481 as an alternative for the AMP. The staff's review of the Code Case N-481 and the required justification in support of the alternative inspection requirements for the pump casings identified that the applicant had submitted its evaluation (ADAMS Accession No. ML011200090) that included a time-dependent fatigue flaw growth analysis. However, the LRA did not discuss the TLAA disposition of ASME Code Case N-481. By letter dated May 2, 2011, the staff issued RAI 4.1-2 asking the applicant to justify the absence of TLAA identification in the LRA for the RCP casing regarding the application of Code Case N-481. The staff's evaluation of RAI 4.1-2 is documented in SER Section 4.7.6.

The staff reviewed the CUF values provided by the applicant, in Table 3-3 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011) and confirmed that the design CUF values for the Class 1 components associated with the RCP are less than the design limit of 1.0. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation, and it will initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of the RCP casings will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The applicant's Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant's Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant's Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Pressurizer Fatigue. The staff reviewed LRA Section 4.3.2.2.5 on fatigue of the pressurizer to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff's review of USAR Table 5.2-1 confirmed that the design code for the pressurizer was the 1968 edition of ASME Code, Section III, inclusive of the 1968 summer addenda. The staff reviewed the CUF values provided by the applicant, in Table 3-4 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011), and confirmed that the design CUF values for the Class 1 components associated with the pressurizer are less than the design limit of 1.0. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation, and it will initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of the pressurizer will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The applicant's Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant's Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant's Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Once-Through Steam Generators

Once-Through Steam Generators Fatigue. The staff reviewed LRA Section 4.3.2.2.6.1 on fatigue of the OTSGs to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff noted that LRA Section 4.3 states that the new design cycle limit for the remotely welded plugs was reduced to 33 cycles (transient 32 in LRA Table 4.3-1). During its audit, the staff noted in the applicant's basis documents for metal fatigue TLAAs that manually welded plugs may also be limited to 33 cycles. The staff noted that the applicant's documentation also describes other OTSG tube plug types. Furthermore, the staff noted that by letter dated November 3, 2003, the applicant responded to the staff's RAI regarding the 2002 SG tube inspection (ADAMS Accession No. ML033100370) and stated that there are 36 construction-era welded plugs and 2 of them were repaired in 2003 with remote welded plugs. It is not clear to the staff if other types of weld plugs, such as the 36 construction-era welded plugs and the 2 repaired welded plugs that were not discussed in the LRA Section 4.3.2.2.6.1, have applicable design fatigue evaluations. It is also not clear to the staff whether these other types of plugs are bounded by the remotely welded plugs, which have a limit of 33 cycles for transient 32. By letter dated May 2, 2011, the staff issued RAI 4.3-7 requesting that the applicant clarify whether there are other types of plugs in addition to remote welded plugs and whether these additional types of plugs have applicable fatigue design analyses. In addition, the applicant was asked to provide the applicable design transients and associated cycle limits for these plugs.

In its response dated June 17, 2011, the applicant stated that the OTSG remote weld plugs have a limited design life of 33 HU/CD cycles to maintain a fatigue usage of less than 1.0. The applicant also stated that the OTSG tube repairs include explosive tube plugs, welded U-cup plugs, rolled tube plugs, sleeve plugs, mechanical plugs, and welded tube plugs. The applicant clarified that only the remotely or manually welded tube plugs, which includes construction era and repaired welded plug have fatigue analyses. The applicant stated that the remote welded plugs are the most limiting and, therefore, bound the other welded tube plugs.

The staff finds the applicant's response acceptable because the applicant confirmed that only the construction era and repair welded tube plugs have fatigue analyses associated with their design. Additionally, the fatigue analysis for the repair welded tube plugs bound the construction era welded tube plugs, which are managed by the applicant's Fatigue Monitoring Program to ensure that the fatigue usage limit for the repaired welded tube plugs are not exceeded. The staff's concern described in RAI 4.3-7 is resolved.

The staff noted that, in LRA Section 4.3.2.2.6.1, the applicant stated that the SGs were analyzed for fatigue by the OEM and that the CUFs for limiting locations were calculated to be less than 1.0 based on the design transients. The staff reviewed the CUF values provided by the applicant, in Tables 3-5 and 3-6 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011), and confirmed that the design CUF values for the Class 1 components associated with the OTSGs are less than the design limit of 1.0. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation, and it will initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of the OTSGs will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The applicant’s Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant’s Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant’s Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Once-Through Steam Generators Tube Sleeves Fatigue. The staff reviewed LRA Subsection 4.3.2.2.6.2 on fatigue of OTSG tube sleeves (rolls) to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis remains valid during the period of extended operation.

The staff reviewed the applicant’s TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.1, which state that the operating transient experience and a list of the assumed transients used in the existing CUF calculations for the current operating term are reviewed to ensure that the number of assumed transients would not be exceeded during the period of extended operation.

The staff noted that LRA Subsection 4.3.2.2.6.2 states that the sleeves are used as a repair option for which ASME Code, Section III, does not provide design rules but allows the demonstration of structural adequacy to withstand cyclic loadings via fatigue testing per ASME Code, Section III, Appendix II-1500. The staff reviewed Appendix II, paragraph II-1500, of the ASME Code, Section III, and confirmed that the Code allows the use of fatigue testing as a means to demonstrate the adequacy of a component to withstand cyclic loading. During its audit, the staff also reviewed the applicant’s basis document for metal fatigue TLAAs and noted that the fatigue tests were based on the startup design transients for OTSG with a bounding number of 360 cycles. The staff compared the limit with the USAR Table 5.1-8 transient allowable cycle limit of 240 startup cycles and concluded that the bounding number of 360 cycles will not be exceeded during the period of extended operation.

Based on its review, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis of the OTSG tube sleeves remains valid during the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.1 because the number of cycles for the startup transient will not exceed the limits established in the OTSG tube sleeve fatigue tests.

Once-Through Steam Generators Auxiliary Feedwater Modification. The staff reviewed LRA Section 4.3.2.2.6.3 on fatigue of the OTSG AFW modification to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant’s TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant’s program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

LRA Section 4.3.2.2.6.3 states that AFW initiations (transients 30A and 30B in LRA Table 4.3-1) are currently at 196.5 and 224.5 cycles, respectively. The staff noted that transients 30A and 30B are projected to a maximum of 387 and 442 cycles, respectively, through the period of extended operation, and these 60-year projections exceed the 300 design cycles for the AFW thermal sleeve. The staff noted that transients 30A and 30B in LRA Table 4.3-1 are identified as "Auxiliary Feedwater Bolted Nozzle" (1-1 and 1-2). It is not clear to the staff whether these AFW injection transients refer to those transients identified in LRA Table 4.3-1. During its audit, the staff noted that the applicant's basis documents for the metal fatigue TLAA indicated that the 3-in. diameter AFW nozzles are limited to 1,447 cycles of AFW initiation based on the CUF of 1.0 for the studs. It is not clear to the staff whether the design cycle limit of 1,447 cycles for "AFW initiation" is tracked in the applicant's Fatigue Monitoring Program.

By letter dated May 2, 2011, the staff issued RAI 4.3-8 requesting that the applicant clarify how the "auxiliary feedwater injection transient" for the modified AFW thermal sleeve design is related to transient 30A, "Auxiliary Feedwater Bolted Nozzle 1-1," and transient 30B, "Auxiliary Feedwater Bolted Nozzle 1-2," in LRA Table 4.3-1. The staff also asked the applicant to clarify the cycle limit of 1,447 for the "AFW initiations" transient discussed in the basis document and to explain whether the "AFW initiation" transient will be monitored by the Fatigue Monitoring Program during the period of extended operation.

In its response dated June 17, 2011, the applicant stated that the AFW injection transient was used to evaluate the AFW nozzle thermal sleeves, AFW nozzle studs, and AFW nozzle flange. The applicant explained that the AFW nozzle thermal sleeves were initially qualified for 300 AFW cycles using conservative analytical techniques, and the thermal sleeves were reanalyzed in December 1982 using numerical methods and were re-qualified for 40,000 AFW cycles. The applicant revised LRA Sections 4.3.2.2.6.3 and A.2.3.2.7 to reflect that the AFW nozzle thermal sleeve is qualified for 40,000 cycles. The applicant stated that the AFW nozzle stud fatigue analysis included the bounding transients of HU/CD, boltup and unbolt, and AFW initiation, and the allowable cycles were reduced from 7,000 to 1,447 to obtain a CUF, for the studs, of less than 1.0.

The applicant also stated that the AFW nozzle flange fatigue analysis included the bounding transients of HU/CD, boltup and unbolt, and AFW initiation, and the cycles were reduced from 7,000 to 875 in the analysis, which resulted in a CUF value of 0.55 for the flange. The applicant stated that transients 30A and 30B in LRA Table 4.3-1, identified as "Auxiliary Feedwater Bolted Nozzle" (1-1 and 1-2), are applicable to the AFW nozzle flanges. The flange is the limiting component; therefore, the transient design cycle limit is set to 875. The applicant revised LRA Sections 4.3.2.2.6.3 and A.2.3.2.7 to reflect that the AFW nozzle flange is the location with a limit on the number of design cycles of 875. The staff noted that LRA Table 4.3-1 indicates the correct limiting number of design cycle of 875 for transients 30A and 30B.

The staff finds the applicant's response acceptable because the applicant's clarification and revision clearly identifies the proper limiting number of design cycles for monitoring by the Fatigue Monitoring Program to ensure that the fatigue usage limits for the OTSG AFW nozzles will not be exceeded. The staff's concerns described in RAI 4.3-8 are resolved.

The staff reviewed the CUF values provided by the applicant, in Tables 3-5 and 3-6 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011), and confirmed that the design CUF values for the Class 1 components associated with the OTSGs are less than the design limit of 1.0. The staff noted that the applicant credited the cycle-counting activities of its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in the RV during the period of extended operation, and it will initiate corrective actions to ensure the design cycles and design limit of 1.0 will not be exceeded. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of the OTSGs AFW header modification will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The applicant's Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The applicant's Fatigue Monitoring Program includes action limits and corrective actions that will ensure that the CUF design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the applicant's Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Once-Through Steam Generators Tubes and Tube Stabilizers Flow-Induced Vibration. The staff reviewed LRA Section 4.3.2.2.6.4 on FIV of the OTSG tubes and tube stabilizers to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis has been projected the period to the end of the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.2, which state that the revised CUF calculations are reviewed to ensure that the CUF remains less than or equal to 1.0 at the end of the period of extended operation.

The staff noted that the 40-year design CUF of an un-repaired tube next to the open lane is 0.443, and the applicant calculated the projected 60-year CUF by multiplying 0.443 by a factor of 1.5. The staff noted that the resulting CUF of 0.665 remains less than the design limit of 1.0. The staff finds the use of a 1.5 factor projection basis reasonable for design basis CUF values that are based on a 40-year design life because 1.5 provides a reasonable scale to project to 60 years from the 40-year design CUF, and the resulting estimated 60-year CUF provides a gauge of how much margin is available before the design limit of 1.0 is reached.

The staff noted that, in LRA Section 4.3.2.2.6.4, the applicant stated the CUF for the 3/8-in. tube stabilizers was calculated using both high-cycle (FIV) and low-cycle (transients) fatigue, with 40-year design basis CUF values of 0.12 for the tube-to-stabilizer weld and 0.07 for the nail. However, based on the description provided in the LRA, it was not clear to the staff whether the CUF values of 0.12 and 0.07 for the tube-to-stabilizer weld and the nail, respectively, included both high-cycle and low-cycle fatigue. It was also not clear why only the FIV portion of these CUF values are increased by 1.5 to demonstrate that the TLAA is valid for the period of extended operation. By letter dated May 2, 2011, the staff issued RAI 4.3-20 requesting that the applicant clarify whether the CUF values are calculated considering both high-cycle and low-cycle fatigue. The staff also asked the applicant to provide the disposition, with the associated basis, in accordance with 10 CFR 54.21(c)(1) for the low-cycle (transient) portion of the fatigue TLAA for the tube-to-stabilizer weld and nail.

In its response dated June 17, 2011, the applicant confirmed that the CUFs for the 3/8-in. tube stabilizers are calculated using both high-cycle (FIV) and low-cycle (thermal transients) fatigue. The applicant clarified that LRA Section 4.3.2.2.6.4 applies to the disposition of the high-cycle fatigue TLAA for the SG tubes and stabilizers. The low-cycle fatigue TLAA of the OTSG locations, including the stabilizers, is addressed in LRA Section 4.3.2.2.6.1. The staff noted that the 40-year design CUF values of 0.12 and 0.07 for the tube-to-stabilizer weld and the nail, respectively, and the applicant calculated the projected 60-year CUF values by multiplying them by a factor 1.5. The staff finds the use of a 1.5 projection reasonable, as described above.

The staff finds the applicant’s response acceptable because the applicant clarified that the high-cycle fatigue TLAA for the SG stabilizer is addressed in LRA Section 4.3.2.2.6.4, and the applicant projected the CUF to remain valid for the period of extended operation. The staff also finds the applicant’s response acceptable because the applicant clarified that the low-cycle fatigue TLAA for the SG stabilizer is addressed in LRA Section 4.3.2.2.6.1, and the applicant is managing cumulative fatigue damage with its Fatigue Monitoring Program, which ensures that the component fatigue usage limit is not exceeded. The staff’s concern described in RAI 4.3-20 is resolved.

The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for OTSG tubes and tube stabilizers FIV analysis have been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.2 because the applicant demonstrated that the projected CUF values will be less than the ASME Code, Section III, design limit of 1.0 through the period of extended operation.

4.3.2.2.3 USAR Supplement

LRA Section A.2.3 provides the USAR supplement summarizing the metal fatigue TLAAs. The staff reviewed LRA Sections A.2.3.1.1, A.2.3.1.5, and A.2.3.2 consistent with the review procedures in SRP-LR Section 4.3.3.3, which state that the reviewer verifies that the applicant provided information to be included in the USAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

The staff’s review of USAR supplement Sections A.2.3.1.1, A.2.3.1.5, and A.2.3.2 of the LRA found that the applicant did not include summary description subsections for the fatigue TLAAs of Class 1 components and piping discussed in LRA Sections 4.3.2.2 and 4.3.2.3:

- RV assembly components, including shells, heads, flanges, nozzles, and bolts of LRA Section 4.3.2.2.1
- OTSGs primary and secondary shell components of LRA Section 4.3.2.2.6.1
- Class 1 piping of LRA Section 4.3.2.3.1

The staff noted that 10 CFR 54.21(d) requires that the USAR supplement contain an appropriate summary description of all TLAA evaluations. By letter dated May 2, 2011, the staff issued RAI 4.3-22 asking the applicant to justify why LRA Section A.2.3 does not include summary descriptions for the aforementioned fatigue TLAAs of Class 1 components and piping.

In its response dated June 17, 2011, the applicant stated that LRA Section A.2.3.2 is revised to include summary descriptions of the TLAA evaluations for the RV, the Class 1 piping, and the OTSGs in the USAR supplement. The staff confirmed that the applicant provided an acceptable summary description of the TLAA evaluations, which included the dispositions of the TLAAs, in accordance with 10 CFR 54.21(c)(1).

The staff finds the applicant's response acceptable because the applicant amended LRA Section A.2.3.2 to include an USAR supplement that contains the summary description of the TLAAs for the RV, the Class 1 piping, and the OTSGs, in accordance with 10 CFR 54.21(d). The staff's concern described in RAI 4.3-22 is resolved.

Based on its review of the USAR supplement, as amended by letter dated June 17, 2011, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.3. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address fatigue TLAAs of Class 1 vessels, pumps, and major components, as required by 10 CFR 54.21(d).

4.3.2.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the low cycle fatigue and FIV analyses for the RVIs and the SG tube sleeves remain valid during the period of extended operation. The staff also concludes that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses for FIV of the surveillance capsule holder tubes of RVIs, the SG tubes and SG tube stabilizers, have been projected to the end of the period of extended operation. The staff also concludes that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue of the RV, RVIs, CRD housings, RCP casings, pressurizer, OTSGs primary and secondary shell components, OTSGs SG tube sleeves and welded plugs, and OTSGs AFW header modification will be adequately managed for the period of extended operation. The staff also concludes that the USAR supplement contains appropriate summary descriptions of the TLAAs, as required by 10 CFR 54.21(d).

4.3.2.3 Class 1 Piping and Valves

4.3.2.3.1 Summary of Technical Information in the Application

LRA Section 4.3.2.3 describes the applicant's TLAAs for metal fatigue of ASME Code, Section III, Class 1 piping and valves. The applicant stated that the RCS piping and the RCPB piping in other systems were designed to the requirements of American National Standards Institute (ANSI) B31.7 draft, (February 1968 with Errata, June 1968) and also meet the design requirements of ANSI B31.7, 1969 edition. The B31.7 Piping Code requires the evaluation of transient thermal and mechanical load cycles and the determination of fatigue usage for Class 1 piping. In addition, the reactor head vent and other piping, designated as quality Group A, B, or C, is designed to ASME Code, Section III, 1971 edition, Class 1, 2, or 3, respectively. The applicant stated that it has no Class 1 piping designed to ANSI B31.1. The applicant's evaluation is documented in the following subsections:

- LRA Section 4.3.2.3.1—Class 1 piping fatigue
- LRA Section 4.3.2.3.2—Class 1 valves fatigue
- LRA Section 4.3.2.3.3—High-energy line break (HELB) postulation

Class 1 Piping Fatigue. The applicant described the following fatigue analyses for Class 1 piping, in LRA Section 4.3.2.3.1:

- reactor coolant piping
- pressurizer surge line
- reactor coolant drains and letdown lines
- HPI lines
- decay heat removal lines
- core flooding lines
- pressurizer safety and relief valve lines

For the reactor coolant piping and the pressurizer safety and relief valve lines, the applicant stated that the CUF values of record were all less than 1.0 based on the design transients identified in LRA Table 4.3-1. LRA Section 4.3.4 contains the details of pressurizer surge line fatigue analyses, where the effects of reactor coolant environment on fatigue are also addressed. For the reactor coolant drains and letdown lines, the HPI lines, the decay heat removal lines, and the core flooding lines, the applicant stated that the original fatigue analyses were updated based on NRC Bulletin 79-14, and the resulting CUFs were all less than 1.0 for the design transients listed in LRA Table 4.3-1.

For the HPI line, the applicant stated that the fatigue usage for the normal makeup nozzle was mainly due to HPI flow tests. The estimated CUF value of 0.558 consists of 0.513 from 40 flow tests, which is the design number of cycles of flow tests, and all other transients contribute 0.045 of the usage factor. The applicant stated that it will monitor transient cycles, and fatigue of the nozzle will be managed through the period of extended operation.

The applicant stated that all CUFs calculated for Class 1 piping are less than 1.0 based on the design transients identified in LRA Table 4.3-1 and that the Fatigue Monitoring Program will monitor these transients for the period of extended operation to ensure that action is taken before the design cycles are reached. The applicant dispositioned all of these TLAAs in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue of the Class 1 piping will be managed for the period of extended operation by the Fatigue Monitoring Program.

Class 1 Valves Fatigue. LRA Section 4.3.2.3.2 provides the applicant's assessment of the potential metal fatigue TLAA for Class 1 valves. The applicant stated that it reviewed its licensing basis documents to determine if they contained fatigue analyses for Class 1 valves and that 12 valves of 4 in. or greater diameter were identified. The applicant's review of its QA records located the stress reports of record for each of the 12 valves, but no associated fatigue reports were identified. On the basis of this review, the applicant concluded that fatigue analyses for Class 1 valves were not performed, and there is no metal fatigue TLAA for Class 1 valves. The applicant stated that its conclusion is consistent with industry practice at the time the plant was designed and that valve bodies and pump casings were considered robust compared to the piping systems in which they were located; therefore, fatigue of the attached piping was understood to bound the fatigue of the valve bodies. The applicant stated that this is not a TLAA because no fatigue analyses were identified for Class 1 valves.

High-Energy Line Break Postulations. LRA Section 4.3.2.3.3 describes the disposition of the TLAA associated with the use of high-energy line break (HELB) postulations. The applicant stated that, in accordance with USAR Section 3.6.2.1, the criteria given in SRP Sections 3.6.1 and 3.6.2, including Branch Technical Position (BTP) MEB 3-1, were used to determine the pipe break locations, and allowed the elimination of potential break locations where the CUFs were less than 0.1. The identification of HELB locations for the RCS hot leg and cold leg piping was replaced by LBB criteria (in 1990), as discussed in LRA Section 4.7.1. The applicant indicated that its identification of HELB piping locations used the CUFs based on the design transients that are counted by the Fatigue Monitoring Program. The applicant further stated that this program will require action if any of the design cycles are approached, including a review of the HELB location selections, and that the effects of fatigue on the HELB location selection will be managed by the Fatigue Monitoring Program for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2.3 concerning fatigue TLAAs of the Class 1 piping and valves, and its evaluation of the applicant's disposition of these TLAAs is documented in three subsections.

Class 1 Piping Fatigue. The staff reviewed LRA Section 4.3.2.3.1 on fatigue of Class 1 piping to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff noted that the applicant's fatigue TLAAs included the following Class 1 piping of the RCS and RCPB:

- reactor coolant piping
- pressurizer surge line
- reactor coolant drains and letdown lines
- HPI lines
- decay heat removal lines
- core flooding lines
- pressurizer safety and relief valve lines

Based on its review of USAR Table 5.2-1, the staff noted that the design of all of this piping is based on ANSI B31.7 draft (February 1968 with Errata of June 1968) or the 1971 ASME Code, Section III. The staff determined that all of the applicable design codes for the Class 1 piping require CUF-based fatigue analyses.

LRA Section 4.3.2.3.1 states that all CUF values are less than 1.0 for these piping based on the design transients listed in LRA Table 4.3-1. The staff reviewed the CUF values provided by the applicant, in Table 3-7 of AREVA Document 51-9157140-001, in response to RAI 4.3-12 (letter dated June 17, 2011), and confirmed that the design CUF values for the Class 1 components associated with the OTSGs are less than the design limit of 1.0.

The staff noted that the applicant credits its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in Class 1 piping during the period of extended operation. The applicant's program includes monitoring and tracking the number of critical thermal and pressure transients that are significant contributors to the fatigue usage factor, which involves the systematic counting of transient cycles and the evaluation of operating data to ensure that the allowable cycle limits are not exceeded. The staff also noted that the applicant's program incorporates action limits and acceptance criteria to ensure that corrective actions are taken to prevent the fatigue TLAAs from exceeding their acceptance criteria, and to assure that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of Class 1 piping will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 for the following reasons:

- The Fatigue Monitoring Program monitors and tracks the number of design basis transients that will occur through the period of extended operation.
- The Fatigue Monitoring Program includes corrective actions that will ensure that the Code design limit of 1.0 will not be exceeded during the period of extended operation.
- The use of the Fatigue Monitoring Program is consistent with the recommendations of the GALL Report AMP X.M1 for managing cumulative fatigue damage.

Class 1 Valves Fatigue. The staff reviewed LRA Section 4.3.2.3.2 and the applicant's evaluation of the absence of TLAAs for Class 1 valves fatigue to verify the applicant's basis. The staff reviewed the applicant's evaluation and conclusion consistent with the review procedures in SRP-LR Section 4.1.3, which state that the reviewer verifies that the selected analyses do not meet at least one of the six criteria of a TLAA, as defined in 10 CFR 54.3(a).

The staff reviewed the applicant's CLB relevant to the RCPB Class 1 valves but was not able to ascertain the applicable design code(s) for the valves. Specifically, the staff noted that USAR Table 5.2-1 states the following:

- Relief valves and pressurizer safety valves were designed to ASME Code draft Pump and Valve Code, November 1968 edition.
- Loop isolation valves and other valves were designed to ASME Code, Section III, 1971 edition or later.
- Pressurizer pilot-operated relief isolation valves were designed to ASME Code, Section III, 1974 edition with addenda through summer 1976.
- Pressurizer spray line isolation valves were designed to ASME Code, Section III, 1986 edition.

For valves larger than 4-in. nominal pipe size (NPS) that are designed to these Codes, the staff noted that these valves must meet the requirements of NB-3530 through NB-3550 (or Article 4 of 1968 edition of draft Pump and Valve Code). The adequacy of these valves for cyclic conditions is confirmed in accordance with Subsection NB-3553 (or Subarticle 454 of the 1968 edition of the draft Pump and Valve Code), which requires the I_t fatigue usage factors for the valves to be less than a design limit of 1.0. It was unclear to the staff why the fatigue analyses of Class 1 valves were not performed as required by the design code and, as such, why these Class 1 valves are identified as not being a TLAA.

To address this issue, the staff issued RAI 4.1-1, Request 1, Part A, by letter dated May 2, 2011. This RAI requested the applicant to clarify which edition of the ASME Code, Section III, was used for the design of the following valves:

- seal injection flow isolation valve
- pump seal return isolation valve
- letdown cooler inlet valve
- HPI valve
- seal return isolation valve
- makeup isolation valve
- letdown cooler isolation valve
- pressure spray control valve
- pressurizer low-pressure injection valve
- each of the decay heat removal outlet valves

The staff also asked the applicant to justify why an I_t fatigue analysis would not have been required by the applicable ASME Code, Section III edition of record for each valve. If an I_t fatigue analysis was required for the valve, the staff asked the applicant to justify why the analysis would not need to be identified as a TLAA in accordance with the requirements of 10 CFR 54.21(c)(1).

The applicant's July 22, 2011, response to RAI 4.1-1, Request 1, Part A, stated that, for ASME Code, Section III editions equal to the 1971 edition or more recent editions, the NB 3500 requirements would have required a CUF or I_t fatigue analysis if the valves were greater than 4-in. NPS (i.e., if the valves were designated as large bore valves). The applicant clarified that the 1968 draft Pump and Valve Code imparts equivalent I_t fatigue analysis requirements for those valves greater than 4-in. NPS.

The applicant clarified that it reviewed the Class 1 piping and instrument diagrams (P&IDs) to identify those Class 1 valves that are greater than 4-in. NPS and, as a result of this search, the following 12 Class 1 valves were identified as large bore Class 1 valves:

- low-pressure injection system outboard containment isolation valves (Valve Nos. DH1A and DH1B)—10-in. NPS, designed to the 1968 draft ASME Pump and Valve Code
- decay heat removal outlet system containment isolation valves (Valve Nos. DH11 and DH12)—12-in. NPS, designed to the 1968 draft ASME Pump and Valve Code
- low-pressure injection system stop check inside containment isolation valves (Valve Nos. DH76 and DH77)—10-in. NPS, designed to the 1971 edition of the ASME Code, Section III, inclusive of the summer 1971 addenda

- decay heat removal outlet system bypass valves (Valve Nos. DH21 and DH23 in the bypass lines around isolation valves DH11 and DH12)—8-in. NPS, designed to the 1971 edition of the ASME Code, Section III
- core flood system stop check isolation valves (Valve Nos. CF28, CF29, CF30, and CF31)—14-in. NPS, designed to the 1971 ASME Code, Section III, inclusive of the winter 1972 addenda

However, the applicant clarified that its search of the Davis-Besse plant records did not locate any CUF or I_t fatigue analyses for these large bore Class 1 valves. The applicant stated that, to address this issue, it is amending LRA Appendix A and Table A-1 (the LRA Commitment Table) to include Commitment No. 46, as follows, to perform CUF or I_t fatigue analyses for these large bore Class 1 valves:

> FENOC commits to perform a fatigue evaluation in accordance with the requirements of the ASME Code of record for the Davis Besse Class 1 valves that are greater than 4 inches nominal pipe size. The applicable valve identification numbers are CF28, CF29, CF30, CF31, DH76, DH77, DH11, DH12, DH1A, DH1B, DH21, and DH23.

The applicant also provided a new USAR supplement summary description in LRA Section A.2.3.2.13, “Class 1 Valves Fatigue,” for large-bore Class 1 Valve TLAAs, as required by 10 CFR 54.21(d).

The staff confirmed that the draft 1968 ASME Pump and Valve Code and the cited editions of the ASME Code, Section III, would not require the performance of CUF or I_t metal fatigue analyses for Class 1 valves that were less than or equal to 4-in. NPS. However, it would have required either a CUF or I_t metal fatigue analysis if the valve was greater than 4-in. NPS. Thus, based on the applicant’s response, the staff concluded that the 12 large bore Class 1 valves identified by the applicant were the appropriate Class 1 valve components that should have metal fatigue analyses, unless the applicant could demonstrate that it was appropriate to have waived a particular large bore Class 1 valve from a fatigue analysis under applicable Code fatigue analysis exemption or waiver provisions. The staff found that the applicant provided an acceptable basis for resolving the question in RAI 4.1-1, Request 1, Part A. The staff found also that the applicant appropriately identified which Class 1 valves would need to be analyzed in accordance with either a CUF or I_t fatigue analysis for the following reasons:

- The applicant’s basis is in compliance with the applicable design code provisions.
- The applicant appropriately amended the LRA to identify that the 12 referenced large bore Class 1 valves were required to receive appropriate metal fatigue analyses.
- The applicant treated the future CUF analyses for these valve components (Commitment No. 46) as a TLAA for the application.

The staff review and evaluation of the new TLAA and associated USAR supplement section for these large bore Class 1 valves is provided below in this SER Section, including an evaluation on whether the commitment in LRA Commitment No. 46 provides an acceptable basis for dispositioning the TLAA for these valves in accordance with 10 CFR 54.21(c)(1)(iii). With the identification of these analyses as TLAAs, the staff’s concern described in RAI 4.1-1, Request 1, Part A, is resolved.

By letter dated May 2, 2011, RAI 4.1-1, Request 1, Part B, requested that the applicant resolve apparent inconsistencies between relevant information in USAR Table 5.1-1b and USAR Table 5.2-1. Specifically, the staff asked the applicant to confirm that the “pressurizer relief isolation valve” in USAR Table 5.1-1b correlates to the “relief valve” in USAR Table 5.2-1. The staff also asked the applicant to confirm that the “pressurizer pilot-operated relief valve (PORV)” in USAR Table 5.1-1b correlates to the “pressurizer pilot-operated relief isolation valve” in USAR Table 5.2-1. If these items cannot be confirmed, the applicant was asked to identify which design codes of record are applicable for the design of the “pressurizer relief isolation valve” and the “pressurizer pilot-operated relief valve,” as listed in USAR Table 5.1-1b.

The applicant’s July 22, 2011, response to RAI 4.1-1, Request 1, Part B, confirmed the component identification correlations that were presumed by the staff during its review. Specifically the applicant confirmed that the “pressurizer relief isolation valve” in USAR Table 5.1-1b does correlate to the “relief valve” in USAR Table 5.2-1 and that the “pressurizer pilot-operated relief valve (PORV)” in USAR Table 5.1-1 b does correlate to the “pressurizer pilot-operated relief isolation valve” in USAR Table 5.2-1. The applicant also administratively confirmed that the design code for the pressurizer relief isolation valve is the 1974 edition of the ASME Code, Section III, inclusive of the summer 1976 addenda, and the design code for the pressurizer PORV is the 1968 edition of the draft ASME Pump and Valve Code.

The staff noted that the applicant’s response confirmed that nomenclature inconsistencies between USAR Tables 5.1-1b and 5.2-1 for the pressurizer relief isolation valve and the pressure PORV were really referring to the same component and to identify the specific design codes that were used for design, fabrication, and installation of these valves at the facility. Thus, the staff found that the applicant’s responses to RAI 4.1-1, Request 1, Part B, was acceptable because it provided the administrative clarifications necessary to confirm the pressurizer valve component nomenclature correlations that were presumed by the staff during its review. The applicant’s response also identified the appropriate design codes used for the design of the pressurizer relief isolation valve and the pressurizer PORV. The staff’s concern described in RAI 4.1-1, Request 1, Part B, is resolved.

By letter dated May 2, 2011, RAI 4.1-1, Request 2, requested that the applicant justify why an I_t fatigue analysis was not required for the pressurizer safety valves and PORV under the provisions of the 1968 draft ASME Pump and Valve Code, as part of the design basis listed under USAR Table 5.2-1, since Sections 452 and 454 of this Code include applicable time-dependent cyclic or fatigue assessment criteria. If an I_t analysis was performed as part of the design basis for these valves, the staff asked the applicant to justify why these analyses do not need to be identified as a TLAA in accordance with 10 CFR 54.21(c)(1).

The applicant’s July 22, 2011, response to RAI 4.1-1, Request 2, clarified that the pressurizer safety valves (Valve Nos. RC13A and RC13B at the facility) and the pressurizer PORV (Valve No. RC2A) were all designed to the draft 1968 ASME Pump and Valve Code. The applicant confirmed that the 1968 draft ASME Pump and Valve Code required an I_t fatigue analysis to be performed if the valves were greater than 4-in. in NPS, or for valves less than or equal to 4-in. NPS if specified in the owner’s design specification. The applicant clarified that these valves were all less than or equal to 4-in. NPS, and confirmed that the owner’s design specifications for the valves did not require the applicant to perform an I_t fatigue analysis for the valves.

The staff noted that the applicant’s response was consistent with the staff’s understanding of the requirements in the draft 1968 draft ASME Pump and Valve Code. Specifically, the protocols used in the 1968 draft ASME Pump and Valve Code establish when an I_t fatigue analysis would have been required for a Class 1 valve procured, designed, analyzed, and installed in accordance with the 1968 draft ASME Pump and Valve Code specification's design rules. Based on this review, the staff found that the applicant's response to RAI 4.1-1, Request 2, provided an acceptable basis for concluding that I_t fatigue analyses would not be needed for the pressurizer safety valves and the pressurizer PORV for the following reasons:

- The staff has confirmed that the 1968 draft ASME Pump and Valve Code would not have required the applicant to perform CUF or I_t fatigue analyses for the valves based on their NPS.
- The owner's procurement specifications for these valves did not require the performance of either a CUF or I_t fatigue analysis as a condition for valve procurement.

The staff's concern described in RAI 4.1-1, Request 2, is resolved.

By letter dated May 2, 2011, RAI 4.1-1, Request 3, requested that the applicant justify why an I_t fatigue analysis was not required for the pressurizer pilot-operated relief isolation valve (as referenced in USAR Table 5.2-1) in accordance with paragraphs NB-3545.3 and NB-3550 of the 1974 edition of the ASME Code, Section III, and the provisions for performing I_t fatigue analyses in paragraph NB-3553. If an I_t analysis was performed as part of the design basis for the pressurizer pilot-operated relief isolation valve, the staff asked the applicant to justify its basis for concluding that the I_t fatigue analysis for the valve would not need to be identified as a TLAA in accordance with the requirement in 10 CFR 54.21(c)(1).

By letter dated May 2, 2011, RAI 4.1-1, Request 4, requested that the applicant justify why an I_t fatigue analysis was not required for the pressurizer spray line isolation valve in accordance with paragraphs NB-3545.3 and NB-3550 of the 1986 edition of the ASME Code, Section III, and the provisions for performing I_t fatigue analyses in paragraph NB-3553. If an I_t analysis was performed as part of the design basis for the pressurizer spray line isolation valve, the staff asked the applicant to justify its conclusion that the I_t fatigue analysis for the valve would not need to be identified as a TLAA for the LRA in accordance with 10 CFR 54.21(c)(1).

The applicant's July 22, 2011, response to RAI 4.1-1, Requests 3 and 4, clarified that the NB-3513 and NB-3563 paragraph provisions in the 1974 and 1986 editions of the ASME Code, Section III, did not require the applicant to perform an I_t fatigue analysis for a Class 1 valve that was designed and analyzed to the Code's design criteria if the valve was less than or equal to 4-in. NPS. The applicant also clarified that the pressurizer relief isolation valve (Valve No. RC11) and pressurizer spray isolation valve (Valve No. RC10) are only 2½-in. NPS and, therefore, were not required to be analyzed in accordance with a ASME Code, Section III, paragraph NB-3553 I_t fatigue analysis. The applicant clarified that it confirmed that the owner's purchasing specifications for these valves did not specifically request the performance of CUF or I_t fatigue analyses as a condition for valve procurement.

The staff reviewed the 1974 and 1986 editions of the ASME Code, Section III, Subarticle NB-3000 requirements to verify when the Code rules would require the performance of an I_t or CUF fatigue analysis for Class 1 valve. The staff confirmed that paragraph NB-3513 for small-bore Class 1 valves (i.e., valves less than or equal to 4-in. NPS) only require applicant's to perform P-T rating, hydrostatic test rating, and minimum wall thickness and neck thickness assessments for the valves, and did not require the small-bore valves to be analyzed to the cyclical metal fatigue analysis requirements in NB-3553. Based on this review, the staff found that the applicant's response to RAI 4.1-1, Requests 3 and 4, provided an acceptable basis for concluding that CUF and I_t fatigue analyses were not needed for the pressurizer relief isolation valve and the pressurizer spray isolation valve for the following reasons:

- The staff confirmed that the draft 1974 and 1986 editions of the ASME Code, Section III, would not have required the applicant to perform CUF or I_t fatigue analyses for the valves based on their NPS.
- The owner's procurement specifications for these valves did not require the performance of either a CUF or I_t fatigue analysis as a condition for valve procurement.

The staff's concerns described in RAI 4.1-1, Requests 3 and 4, are resolved.

Based on this review, the staff determined that the applicant's metal fatigue analysis basis for the Class 1 valves, as amended by the applicant's responses to the requests of RAI 4.1-1, is acceptable for the following reasons:

- The applicant appropriately amended the application to identify the metal fatigue analyses for the 12 identified large bore Class 1 valves as a TLAA for the LRA.
- The applicant demonstrated, and the staff confirmed, that the design codes for the small Class 1 valves would not have required the applicant to perform metal fatigue analyses as part of the design requirements for the valves.

Therefore, RAI 4.1-1 is resolved.

In its response to RAI 4.1-1, Request 1, Part A, by letter dated July 22, 2011, the applicant amended LRA Sections 4.3.2.3.2 and A.2.3.2.13. The staff reviewed the amended LRA Section 4.3.2.3.2 and the fatigue TLAA for Class 1 valves to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation. This review was consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant's program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

However, the staff noted that, in the applicant's letter dated July 22, 2011, it did not provide clarifying information regarding whether there were any ASME Code, Section III, NB-3222.4(d) fatigue waiver assessments (or equivalent waiver assessments permitted by the 1968 draft ASME Pump and Valve Code) for the 12 large-bore Class 1 valves referenced in Commitment No. 46. Therefore, the staff requested additional information regarding whether fatigue calculations were required for these valves as part of the applicant's CLB.

By letter dated August 11, 2011, the staff issued RAI 4.3.2.3.2-1 requesting that the applicant clarify whether the CUF or I_t analyses for each of the 12 large bore Class 1 valves are required as part of the applicant's CLB. In its response dated October 7, 2011, the applicant stated that, in order to provide the fatigue evaluation requested by the staff, it withdrew Commitment No. 46 and provided a new regulatory commitment in its place to read as follows:

> FENOC will perform a fatigue evaluation in accordance with the requirements of the ASME Code of record for the Davis-Besse Class 1 valves that are greater

> than 4 inches diameter nominal pipe size. The applicable valve identification numbers are CF28, CF29, CF30, CF31, DH76, DH77, DH11, DH12, DH1A, DH1B, DH21 and DH23. LRA Sections 4.3.2.3.2 and A.2.3.2.13, both titled "Class 1 Valves Fatigue," will be revised to include the results of the fatigue evaluations, and these changes will be submitted as an amendment to the Davis Besse LRA no later than May 31, 2012.

The staff confirmed that Commitment No. 46 has been removed from LRA Table A-1 and is defunct. The staff found the removal of Commitment No. 46 reasonable because the staff will complete its review of this issue once the applicant submits the fatigue evaluations for these Class 1 valves and supplements LRA Sections 4.3.2.3.2 and A.2.3.2.13 to include those results.

In its supplemental response to RAI 4.3.2.3.2-1, dated May 25, 2012, the applicant stated that fatigue analyses were prepared for each of the 12 large-bore Class 1 valves in accordance with paragraph NB-3550 of ASME Code, Section III, 1974 edition with addenda through the summer of 1976. The applicant also stated that the CUFs calculated for the Class 1 valves, which are based on nuclear steam supply system design transients, are less than the design limit of 1.0 and the number of occurrences of design transients is tracked by the Fatigue Monitoring Program. The applicant also revised LRA Sections 4.3.2.3.2 and A.2.3.2.13 to include the results of the fatigue evaluations. The staff noted that the code edition and design transients information addressed the staff's request whether fatigue analyses were required as part of the applicant's CLB.

Based on its review, the staff finds the applicant's response to RAI 4.3.2.3.2-1 acceptable because the applicant revised the LRA to provide the metal fatigue TLAA disposition and associated supporting information for its Class 1 valves. Therefore, the staff's concern described in RAI 4.3.2.3.2-1 is resolved. The staff's review of the revised LRA Section 4.3.2.3.2 is documented below.

The staff noted that the applicant credits its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage that may occur in ASME Code, Class 1 valves during the period of extended operation. The applicant's program includes monitoring and tracking the number of critical thermal and pressure transients that are significant contributors to the fatigue usage factor, which involves the systematic counting of transient cycles and the evaluation of operating data to ensure that the allowable cycle limits are not exceeded. The staff also noted that the applicant's program incorporates acceptance criteria to ensure that corrective actions are taken to prevent these fatigue TLAAs from exceeding their acceptance criteria, and to assure that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for its Class 1 valves and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue of the ASME Code, Class 1 valves will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP–LR Section 4.3.2.1.2.3 because the applicant's Fatigue Monitoring Program tracks the number design basis transients that will occur through the period of extended operation and includes corrective actions that will ensure that the assumption made in these ASME Code, Class 1 valves fatigue analyses will not be exceeded during the period of extended operation.

<u>High-Energy Line Break Postulations</u>. The staff reviewed LRA Section 4.3.2.3.3 and the TLAA disposition of HELB postulations to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of critical thermal and pressure transients.

The staff reviewed USAR Section 3.6, which includes the criteria used by the applicant for HELB postulation, which is based on SRP Sections 3.6.1 and 3.6.2, including BTP MEB 3-1. The staff noted that one of these criteria, which allows HELB locations to be eliminated, is whether the CUF value will be 0.1 or less. The staff noted that the cycle limits in LRA Table 4.3-1 correspond to the CUF design limit of 1.0 under the ASME Code, Section III, criteria. Therefore, the staff needs additional information related to the cycle limits that are applicable to HELB piping locations because they may be less than those provided in LRA Table 4.3-1 and monitored by the applicant's Fatigue Monitoring Program. The staff also noted that the Fatigue Monitoring Program does not address the acceptance criteria or the cycle-based action limits for these HELB locations. By letter dated May 2, 2011, the staff issued RAI 4.3-13 requesting that the applicant provide the design-basis transients and associated cycle limits applicable to each of the HELB piping locations that are within the scope of LRA Section 4.3.2.3.3. The staff also asked the applicant to justify that the Fatigue Monitoring Program can adequately ensure the CUF for HELB locations remain below 0.1 by using systematic counting of plant transient cycles associated with HELB analysis, and to provide any appropriate revisions to the Fatigue Monitoring Program.

In its response dated June 17, 2011, the applicant stated that the HELB postulation based on fatigue usage is applicable to the following ASME Code Class 1 piping locations: low-pressure injection lines, core flooding lines, letdown lines, and decay heat removal lines. The response also provided a table that lists the design transients that were considered in the fatigue analyses for these ASME Code Class 1 piping locations, with the associated analyzed cycles and 60-year projected cycles. The staff noted that the number of cycles projected in 60-years is less than the number of cycles assumed in the fatigue analyses for these HELB locations, with the exception of transient 3 "Power change 8-100%," transient 4 "Power change 100-8%," and transient 11, "Rod Withdrawal Accident." The applicant stated that transients 3 and 4 are not monitored, and its site is a based loaded plant. The staff's evaluation of the applicant's basis for not monitoring transients 3 and 4 is documented in SER Section 4.3.1.2, where the staff agreed with the applicant that it need not monitor for these transients. The staff also noted that transient 11 has not occurred as of February 19, 2008, and finds that the applicant conservatively assumed the 60-year projected cycles is equal to the number of design cycles (40 cycles) to allow for future occurrence. Other than the three transients described above, the staff noted that there is a significant margin between the number of cycles projected to occur after 60-years of operation and the number of cycles assumed in the applicant's fatigue analyses for HELB postulation. The applicant also amended LRA Sections 4.3.2.2.3 and A.2.3.2.1.2 to indicate that the TLAAs for HELB postulations are dispositioned in accordance with 10 CFR 54.21(c)(1)(i), such that the Class 1 HELB postulations remain valid for the period of extended operation.

The staff finds the applicant's response acceptable because the applicant demonstrated that, for these specific Class 1 piping locations associated with the TLAAs for HELB postulations, the number of cycles projected to occur after 60-years of operation are less than the number of cycles assumed in the fatigue analyses for HELB postulations. Additionally, the applicant revised the TLAA disposition indicating that it will be dispositioned in accordance with 10 CFR 54.21(c)(1)(i). The staff's evaluation of the applicant's projection methodology for design transients is documented in SER Section 4.3.1.2. The staff's concern described in RAI 4.3-13 is resolved.

Based on its review, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the HELB postulations remain valid during the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.1 because there is margin between the number of cycles projected to occur after 60 years of operation and the number of assumed cycles in the fatigue analyses of the HELB postulations, and the assumptions in the fatigue TLAAs will not be exceeded during the period of extended operation.

4.3.2.3.3 USAR Supplement

LRA Section A.2.3, as amended by letter dated June 17, 2011, provides the USAR supplement summarizing the metal fatigue TLAAs. The staff reviewed LRA Sections A.2.3.1.2, A.2.3.1.4, and A.2.3.2.11, as amended by letter dated June 17, 2011, consistent with the review procedures in SRP-LR Section 4.3.3.3, which state that the reviewer should verify that the applicant provided information to be included in the USAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA. The SRP-LR also states that the reviewer should verify that the applicant identified and committed in the LRA to any future aging management activities, including enhancements and commitments to be completed before the period of extended operation.

The staff's review of USAR supplement Section A.2.3 of the LRA determined that the applicant did not include a summary description for several metal fatigue TLAAs, including the TLAA of Class 1 piping discussed in LRA Section 4.3.2.3.1.

By letter dated May 2, 2011, the staff issued RAI 4.3-22 requesting that the applicant provide a basis for not including a summary description for the TLAAs of Class 1 piping as a subsection to LRA Section A.2.3.2. In its response dated June 17, 2011, the applicant included LRA Section A.2.3.2.11 "Class 1 Piping," that provided a summary description for its Class 1 Piping. The staff's evaluation of RAI 4.3-22 is documented in SER Section 4.3.2.2.3.

LRA Section A.2.3.2.13, as amended by letters dated July 22, 2011, and May 25, 2012, provides the USAR supplement summarizing the fatigue TLAA for Class 1 valves. The staff reviewed LRA Section A.2.3.2.13, consistent with the review procedures in SRP-LR Section 4.3.3.3, which states that the reviewer verifies that the applicant provided information, to be included in the USAR supplement, that includes a summary description of the evaluation for the fatigue TLAA of Class 1 valves. The applicant provided Commitment No. 46 in its letter dated July 22, 2011. Based on the staff's concern in RAI 4.3.2.3.2-1, the applicant deleted Commitment No. 46 in its letters dated October 7, 2011. The staff found this deletion acceptable, as described in its evaluation of RAI 4.3.2.3.2-1 which is documented in SER Section 4.3.2.3.2.

Based on its review, the staff finds that the information in the USAR supplement, as amended by letters dated June 17, 2011, July 22, 2011, and May 25, 2012, meets the acceptance criteria in SRP-LR Section 4.3.2.3. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address fatigue TLAAs of Class 1 piping, Class 1 valves and HELB postulations, as required by 10 CFR 54.21(d).

4.3.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue analyses of Class 1 piping and Class 1 valves will be adequately managed for the period of extended operation. The staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the HELB postulations remain valid during the period of extended operation. 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).

4.3.3 Non-Class 1 Fatigue Analyses

LRA Section 4.3.3 provides the TLAA evaluation for metal fatigue of non-Class 1 mechanical components. The applicant stated that non-Class 1 components that are quality Group B or C are largely designed and constructed to the ASME Boiler and Pressure Vessel Code, but certain components are built to other codes including B31.1, American Water Works Association (AWWA), and the draft Pump and Valve Code. The applicant's evaluation is documented in the following subsections:

- LRA Section 4.3.3.1—non-Class 1 piping and in-line components
- LRA Section 4.3.3.2—non-Class 1 major components

The staff's review and assessment of these fatigue TLAAs is documented in the two subsections below, which correspond to the applicant's LRA Subsections 4.3.3.1 and 4.3.3.2.

4.3.3.1 Non-Class 1 Piping and In-Line Components

4.3.3.1.1 Summary of Technical Information in the Application

LRA Section 4.3.3.1 describes the applicant's metal fatigue TLAAs for non-Class 1 piping and in-line components. The applicant stated that the fatigue analyses of these non-Class 1 components were based on the design codes that include ASME Code, Section III, Class 2 and Class 3 with respect to thermal (expansion) stresses and ANSI B31.1 for quality Group D components with respect to the number of thermal cycles. In both of these codes, a stress range reduction factor of less than 1.0 is applied to the allowable stress range if the number of stress cycles exceeds 7,000. The applicant compared this cycle limit against its 60-year projections for its thermal transients, listed in LRA Table 4.3-1, as applicable to these non-Class 1 components and determined that the 7,000-cycles limit will not be exceeded. The applicant dispositioned these metal fatigue TLAAs in accordance with 10 CFR 54.21(c)(1)(i), that the fatigue analyses (stress range reduction factor) for non-Class 1 piping and in-line components remain valid through the period of extended operation.

4.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3.1 on fatigue of non-Class 1 Piping and in-line components to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses will remain valid during the period of extended operation.

The staff reviewed the applicant's TLAA and its corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.2.1, which state that the staff should review relevant information in the TLAA, operating plant transient history, design basis, and CLB (including TS cycle-counting requirements). The SRP-LR also states that the staff should verify that the maximum allowable stress range values for the existing fatigue analysis remain valid for the period of extended operation and that the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.

The staff noted that the applicable design code requirements, to which systems and components important to safety were designed, are listed in USAR Table 3.2-2. The staff noted that these metal fatigue TLAAs are based on the criteria for performing implicit fatigue analyses, as given in the ANSI B31.1 design code (for Group D components) and in ASME Code, Section III (NC-3000 for Class 2 and ND-3000 for Class 3 components), which require an allowable stress range reduction only if the number of full thermal cycles exceeds the limit of 7,000. The staff also reviewed the projected number of occurrences for various plant transients for 60-years of operation, as given in LRA Table 4.3-1, as well as the applicant's estimates for other thermal cycles that do not require monitoring or counting.

The 60-year projections in LRA Table 4.3-1 are based on the number of cycles for each transient that have been accrued as of February 2008 and then linearly extrapolated to the 60 years of operation. As described in SER Section 4.3.1.2, the staff determined that the applicant conservatively considered operating history early in plant life, when transient occurrences were more frequent compared to current operating history, into the 60-year projection methodology. The staff noted that the applicant's Fatigue Monitoring Program counts transient cycles to ensure allowable cycle limits used in the design basis fatigue evaluations analysis are not exceeded during the period of extended operation.

The staff noted that the piping connected to the RCS, main steam system, auxiliary steam system, and main feedwater system experience the same transients that were used in the design of the RCS, as listed in LRA Table 4.3-1. The staff confirmed that there is significant margin between the total number of design transients projected to occur after 60 years of operation, as shown in LRA Table 4.3-1, and the full thermal range transient cycle limit of 7,000.

The staff noted that the transients that occur in the following piping and piping components are routine and based on predictable surveillance testing or periodic cycling. These piping and piping components include those associated with

- the emergency diesels
- the fire pump diesel engine
- the station blackout (SBO) diesel
- the containment air system
- the gaseous radwaste system
- the sampling systems
- the auxiliary steam system
- the station heating system
- piping that connects the fire water storage tank heat exchanger to the fire water storage tank

The staff also noted that the applicant conservatively assumed unanticipated operation and cycling that may occur for the systems described above. The staff noted that, in all instances, the number of estimated cycles in these systems for 60-years of operation were significantly less than the full thermal range transient cycle limit of 7,000. The staff finds it reasonable that the full thermal range transient cycle design limit of 7,000 will not be exceeded during the period of extended operation because of the significant margin between the estimated number of transient cycles and the design limit of 7,000 cycles. These transient occurrences for the piping and piping components in these systems are predictable and routine, and the applicant conservatively incorporated unanticipated events that would lead to additional transients.

Based on its review, the staff confirmed that the full thermal range transient cycle limit of 7,000 used in the applicant's design basis fatigue evaluations associated with the non-Class 1 piping and in-line components will not be exceeded during the extended period of operation; therefore, the maximum allowable stress range values for the existing analyses remains valid. The staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAAs of non-Class 1 piping and in-line components fatigue analyses remain valid during the period of extended operation. Additionally, the analyses meet the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 because the projected total number of full thermal range transients over the period of extended operation for non-Class 1 piping and in-line components does not exceed the 7,000-cycle limit.

4.3.3.1.3 USAR Supplement

LRA Section A.2.3.3.1 provides the USAR supplement summarizing the TLAA for non-Class 1 piping and in-line components fatigue analyses. The staff reviewed LRA Section A.2.3.3.1 consistent with the review procedures in SRP-LR Section 4.3.3.3, which state that the reviewer verifies that the applicant provided information to be included in the USAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the USAR supplement, the staff finds that the supplement meets the acceptance criteria in SRP-LR Section 4.3.2.3. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA of non-Class 1 piping and in-line components fatigue analysis, as required by 10 CFR 54.21(d).

4.3.3.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analyses of non-Class 1 piping and in-line components remain valid during the period of extended operation. The staff also concludes that the USAR supplement contains an adequate summary description of the evaluated TLAAs, as required by 10 CFR 54.21(d).

4.3.3.2 Non-Class 1 Major Components

4.3.3.2.1 Summary of Technical Information in the Application

LRA Section 4.3.3.2 describes the applicant's assessment of non-Class 1 major components subject to fatigue. The applicant stated that the need for fatigue evaluation of non-piping components, which includes heat exchangers, storage tanks, and pumps, is limited based on the design code used. A review conducted by the applicant of the component design codes determined that the applicable design codes include: ASME Code, Section III (Class C or Class 3); ASME Code, Section VIII; the draft ASME Code for Pumps and Valves 1968 (Class 2); Section VIII Division 1; AWWA; Manufacturers Standardization Society; and National Electrical Manufacturers Association. The applicant stated that none of these design codes require fatigue analyses. The applicant stated there are no fatigue analyses and, hence, no TLAAs associated with the non-Class 1 major (non-piping) components.

4.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3.2 and the applicant's evaluation for these non-Class 1 major (non-piping) components to verify the applicant's basis for determining there are no fatigue analyses and, hence, no TLAAs. The staff reviewed the applicant's evaluation and conclusion consistent with the review procedures in SRP-LR Section 4.1.3, which state that the review verifies that the selected analyses do not meet at least one of the criteria of a TLAA, as defined in 10 CFR 54.3(a).

The staff reviewed USAR Table 3.2-2 to confirm the applicable design codes of record for the components that are discussed in LRA Section 4.3.3.2 and then reviewed the design code requirements for fatigue evaluation for these non-Class 1 major (non-piping) components. The staff confirmed that ASME Code, Section III, does not require a fatigue analysis for Class 2 and 3 tanks (less than 15 psig). The staff also confirmed that only pressure vessel and heat exchangers designed under ASME Code, Section VIII, Division 2, Alternative Rules and ASME Code, Section III, NC-3200, explicitly require fatigue analyses.

For the fire water storage tank heat exchanger, the borated water tank heater, and the 10-psig condensate tank designed under ASME Code, Section VIII, Division 1, the staff confirmed that this design code does not require a fatigue analysis. For decay heat removal pumps designed under 1968 draft ASME Code for Pumps and Valves Class 2, the staff confirmed that this design code does not require a fatigue analysis for these components. For the waste gas surge tank and the decay heat removal coolers designed under ASME Code, Section III, Class C, the staff confirmed that this design code does not require a fatigue analysis. For the pressurizer quench tank designed under ASME Code, Section III, Class 3, the staff confirmed that this design code does not require a fatigue analysis. For the AFW pump turbine casings, the intake structure unit heater heat exchangers, the evaporator package condensate drain pumps, the degasifier package drain pumps, and the condensate pumps, the staff noted that, based on each system's function and the nonsafety-related classification, these components would not experience transients that can cause substantial cyclic strains that are significant contributors to the fatigue usage. Therefore, the staff finds it reasonable that fatigue analyses were not required during the design of these components.

Based on its review, the staff finds the applicant's conclusion, that there are no specific TLAAs associated with non-Class 1 major (non-piping) components, acceptable because the applicant demonstrated that its CLB does not contain analyses that consider cumulative fatigue damage for non-Class 1 major (non-piping) components. Therefore, metal fatigue of these non-Class 1 major (non-piping) components is not a TLAA, in accordance with Criterion 6 of 10 CFR 54.3(a).

4.3.3.2.3 USAR Supplement

LRA Section A.2.3.3.2 provides the USAR supplement summarizing the absence of TLAAs for non-Class 1 major (non-piping) components. The staff reviewed LRA Section A.2.3.3.2 consistent with the review procedures in SRP-LR Section 4.3.3.3, which state that the reviewer should verify that the applicant provided information to be included in the USAR supplement that includes a summary description of the evaluation of absence of TLAAs for non-Class 1 major (non-piping) components.

Based on its review of the USAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.3. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the absence of TLAAs for non-Class 1 major (non-piping) components, as required by 10 CFR 54.21(d).

4.3.3.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration that the non-Class 1 major (non-piping) components do not have fatigue analyses that would be identified as a TLAA, in accordance with the requirements 10 CFR 54.3(a). The staff also concludes that the USAR supplement contains an appropriate summary description of the evaluation of the absence of TLAA, as required by 10 CFR 54.21(d).

4.3.4 Effects of Reactor Coolant Environment on Fatigue

4.3.4.1 Summary of Technical Information in the Application

LRA Section 4.3.4 describes the applicant's evaluation of the effect of reactor coolant environment on component fatigue life for the period of extended operation. The applicant stated that industry data indicates that certain environmental effects such as temperature and dissolved oxygen content in the reactor coolant could result in greater susceptibility to metal fatigue than those predicted by fatigue analyses based on the ASME Code, Section III, fatigue design curves. The LRA states that the Code design curves were based on laboratory tests in air and at low temperatures, which may not be sufficient to account for actual plant operating environments. As described in the LRA, EAF is evaluated for license renewal in accordance with the guidelines of NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," and EPRI report MRP-47, "Guidelines for Addressing Fatigue Environmental Effects in a License Renewal Application." The applicant stated that NUREG/CR-6260 identifies locations of interest for consideration of environmental effects for B&W PWRs.

The applicant stated that plant-specific locations corresponding to the NUREG/CR-6260 locations were identified and the ASME Code design fatigue CUFs were adjusted by the environmental life correction factors (F_{en}) to obtain the EAF results for these locations. F_{en} values were calculated using material-specific guidance contained in the following documents:

- NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low Alloy Steels," for carbon and low alloy steels
- NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," for austenitic stainless steels
- NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials," for Ni-based alloys

The design CUFs, adjusted CUFs, and environmentally-adjusted CUFs (U_{en}) for 15 plant-specific locations are summarized in LRA Table 4.3-2. The applicant stated that the U_{en} for all locations are less than 1.0 except for the HPI/makeup nozzle safe end and the associated welds. The applicant also stated that it will replace all four HPI/makeup nozzle safe ends and the associated welds prior to entering the period of extended operation.

The LRA states that the effects of EAF will be managed for the period of extended operation by the Fatigue Monitoring Program. The Fatigue Monitoring Program will be used to manage the effects of reactor coolant environment for each of the NUREG/CR-6260 locations by counting the design transients that were based upon in the EAF analyses. The applicant dispositioned the EAF evaluations for all the 15 NUREG/CR-6260 locations in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

4.3.4.2 Staff Evaluation

The staff noted that the applicant addressed the effects of the reactor coolant environment on component fatigue life consistent with the guidance in the SRP-LR and the staff's recommendations for resolving Generic Safety Issue No. 190 (GSI-190), dated December 26, 1999. The staff also noted that, consistent with Commission Order No. CLI-10-17, dated July 8, 2010, the evaluations associated with the effects of the reactor coolant environment on component fatigue life do not fall within the definition of a TLAA in 10 CFR 54.3(a) because these evaluations are not in the applicant's CLB. Nevertheless, the applicant credited its Fatigue Monitoring Program to manage the effects of EAF. Therefore, the staff reviewed LRA Section 4.3.4 and the evaluations for EAF to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The staff reviewed the applicant's EAF evaluations and the corresponding disposition consistent with the review procedures in SRP-LR, Revision 2, Section 4.3.3.1.3, which state that the reviewer should verify that the applicant has addressed the effects of the coolant environment on component fatigue life as AMPs are formulated in support of license renewal. If the applicant has chosen to assess the impact of the reactor coolant environment on a sample of critical components, the review verifies the following:

- The critical components include a sample of high-fatigue usage locations. This sample is to include the locations identified in NUREG/CR-6260, as a minimum, and propose alternatives based on plant configuration.
- The sample of critical components has been evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses or using the methodology provided in NUREG/CR-6909. If the Class 1 component was designed to a Code not requiring CUF, a new environmental CUF calculation has been performed or addressed in an appropriate license renewal commitment.
- Formulae for calculating the F_{en} are those contained in several NUREG/CR reports as specified in SRP-LR, Revision 2, Section 4.3.3.1.3, or an approved technical equivalent.

LRA Section 4.3.4 discusses the methodology to determine the locations that require an EAF evaluation consistent with NUREG/CR-6260. The staff noted that LRA Table 4.3-2 contains 15 plant-specific locations, which are based on the six generic components identified in NUREG/CR-6260.

SRP-LR, Revision 2, Section 4.3.3.1.3 states that the impact of the reactor coolant environment on a sample of critical components should include the locations identified in NUREG/CR-6260, as a minimum, and that additional locations may be needed. It was not clear to the staff whether the applicant confirmed that the plant-specific locations listed in LRA Table 4.3-2 were bounding for the generic NUREG/CR-6260 components. Furthermore, the staff noted that the applicant's plant-specific configuration may contain locations that should be analyzed for the effects of the reactor coolant environment other than those identified in NUREG/CR-6260. By letter dated May 2, 2011, the staff issued RAI 4.3-14, asking the applicant to confirm and justify that the plant-specific locations listed in LRA Table 4.3-2 are bounding for the generic NUREG/CR-6260 components. Furthermore, the staff requested that the applicant confirm and justify that the locations listed in LRA Table 4.3-2 that were selected for EAF analyses consists of the most limiting locations for the plant (beyond the generic locations identified in the NUREG/CR-6260). If these locations in LRA Table 4.3-2 are not bounding for the plant, the staff asked the applicant to clarify the locations that require an EAF analysis and explain the actions that will be taken for these additional locations.

In its response dated June 17, 2011, the applicant stated that a response was previously provided in letter dated June 3, 2011, in response to RAI B.2.16-2, to address the issue of EAF for locations beyond the generic locations identified in the NUREG/CR-6260. The applicant also stated that it provided the required changes to LRA Sections A.1.16 and B.2.16 and LRA Table A-1. In its June 3, 2011, letter, the applicant compiled a listing of all its design CUFs, which were then multiplied by a maximum F_{en} value to determine the bounding EAF CUFs (CUF_{en}). The applicant provided the following bounding F_{en} values for a PWR reactor coolant environment and the associated NUREG/CR report that was used for each value:

- low alloy steel—F_{en} max of 2.45 (NUREG/CR-6583) [Note that the June 3, 2011, letter states a value of 2.54, which the applicant identified as a typographical error and corrected to 2.45 by letter dated Mary 25, 2011)
- carbon steel—F_{en} max of 1.74 (NUREG/CR-6583)
- stainless steel—F_{en} max of 15.35 (NUREG/CR-5704)
- Ni-based alloy—F_{en} max of 4.52 (NUREG/CR-6909)

As a result, the applicant provided a list of additional locations not evaluated in the LRA for EAF for which the bounding estimates of CUF_{en} exceeded the design limit of 1.0. The staff noted that the applicant provided an enhancement to the "scope of program" program element for its Fatigue Monitoring Program and committed (Commitment No. 42) to enhance this program to evaluate additional plant-specific component locations in the RCPB that may be more limiting than those considered in NUREG/CR-6260 for environmental effects. The staff's evaluation of the Fatigue Monitoring Program, RAI B.2.16-2, and the bounding F_{en} values listed above, is documented in SER Section 3.0.3.2.6.

The staff finds the applicant's response acceptable because the applicant committed to evaluate additional plant-specific component locations in the RCPB that may be more limiting than those considered in NUREG/CR-6260 for environmental effects as part of its Fatigue Monitoring Program, which is consistent with SRP-LR, Revision 2, Section 4.3.2.1.3 and GALL Report AMP X.M1. The staff's concern described in RAI 4.3-14 is resolved.

In LRA Table 4.3-2 for the RV inlet and outlet nozzles and the pressurizer surge nozzle safe-end, adjusted values of CUF were determined by identifying the incremental fatigue contributions attributed to the full NSSS design transient cycles for design CUF and reducing those incremental contribution based on the 60-year projected cycles. Specific to the HPI/makeup nozzle and stainless steel safe-end, the applicant stated that it still maintained the full-set of 40-year nuclear steam supply system (NSSS) design transients while conservatism in the design analyses was removed. It is not clear to the staff which incremental contributions were reduced based on the 60-year projected cycles and which transients and the associated numbers of cycles were used in the analysis for the RV inlet and outlet nozzles and the pressurizer surge nozzle safe-end. For the HPI/makeup nozzle and stainless steel safe-end, it is not clear to the staff which elements in the original design basis fatigue evaluations were adjusted to remove conservatism in the original design CUF, and the basis for these adjustments. By letter dated May 2, 2011, the staff issued RAI 4.3-16 asking the applicant to identify the changes that were made to reduce the conservatism and justify the reduction of conservatism in the original CUFs of record for each location.

In its response dated June 17, 2011, the applicant stated that for the RV inlet and outlet nozzles, the CUF was reduced by using the current design cycles for transients 3 and 4 and 60-year projections for transients 5 and 6 in LRA Table 4.3-1. The applicant stated that large contributions to fatigue were due to transients 3–6. Specifically, the original analyses used 48,000 cycles for transients 3 and 4, and 8,000 cycles for transients 5 and 6. The staff noted that the use of 48,000 cycles was conservative since the current design cycles for transients 3 and 4 are 1,800; the staff finds it reasonable that the evaluation uses the number of current design cycles. The applicant stated that the CUF reduction was obtained by using the current design of 1,800 cycles for transients 3 and 4 and the projected cycles for 60-year for transients 5 and 6, which are 67 and 140, respectively. The staff's review of the applicant's 60-year projection methodology is documented in SER Section 4.3.1.2. Therefore, the design CUF for the RV inlet nozzle was reduced from 0.829 to 0.146, and the design CUF for the RV outlet nozzle was reduced from 0.768 to 0.335 for the EAF evaluations reported in LRA Table 4.3-2. The staff noted that the CUF contribution for the remaining NSSS design transients listed in LRA Table 4.3-1 was unchanged.

Based on its review, the staff finds the conservatism removed by the applicant for the RV inlet and outlet nozzles EAF evaluations acceptable for the following reasons:

- The applicant used, for transients 3 and 4, the number of cycles from its current design.
- The applicant used, for transients 5 and 6, the 60-year projected cycles that were based on actual operating history of the plant.
- The applicant's Fatigue Monitoring Program will ensure that this evaluation remains valid and the Design Code limit of 1.0, including environmental effects, will not be exceeded during the period of extended operation.

The applicant stated that the original design CUF for the pressurizer surge nozzle safe end consists of 0.108 from HU/CD transients (the current design is 240 cycles for transients 1A and 1B) and all other NSSS design transients contribute a negligible amount. The applicant used the 60-year projections of 128 HU/CD transients to reduce the design CUF from 0.108 to 0.0581 for the EAF evaluation reported in LRA Table 4.3-2.

Based on its review, the staff finds the conservatism removed by the applicant for the pressurizer surge nozzle safe end EAF evaluation acceptable because, for transients 1A and 1B, the applicant used 60-year projected cycles for these transients in the calculations of CUF_{en}, which is based on the actual operating history of the plant. Use of data from the applicant's actual operating history provides a more realistic accumulated fatigue usage through the period of extended operation. Additionally, the applicant's Fatigue Monitoring Program will ensure that the evaluation remains valid and the Design Code limit of 1.0 is not exceeded during the period of extended operation.

The applicant stated that the original design CUF for the carbon steel HPI nozzle is 0.589, and the major contributions to this CUF is from transient 12 (hydro-test) and transient 23 (SG filing, draining, flushing and cleaning). The applicant also stated that the stress for transient 23, was conservatively calculated in the original analysis based on the same pressure as the hydro-test (i.e., 3125 psig) plus other stresses from thermal moments and mechanical loads. However, in accordance with its RCS functional specification, the pressure range permitted during transient 23 is only 485 psig. The staff finds it reasonable that the applicant reduced the stress due to pressure from transient 23 in its EAF evaluation because this reduction is consistent with the actual pressure permitted by the applicant's RCS functional specification during the transient. The applicant also stated that the stresses due to thermal moments and mechanical loads for transient 23 and the usage factor contributions from the other NSSS transients were not changed. The design usage factor for the carbon steel nozzle was reduced from 0.589 to 0.348 for the EAF evaluation reported in LRA Table 4.3-2.

Based on its review, the staff finds the conservatism removed by the applicant for the carbon steel HPI nozzle EAF evaluation acceptable because the evaluation considered the stresses from the actual pressure on the component that occurs during the transient, as defined by the applicant's RCS functional specifications. Additionally, the applicant's Fatigue Monitoring Program will ensure that this evaluation remains valid and the design Code limit of 1.0 will not be exceeded during the period of extended operation.

The applicant stated that the design CUF for the stainless steel HPI/makeup nozzle safe end was reduced from 0.664 to 0.550 for the EAF evaluation reported in LRA Table 4.3-2. The applicant clarified that transient 22 (now transient 22 A1), as defined in the RCS functional specification, cannot occur at the applicant's site because the HPI pump shutoff head is approximately 1,600 psig. The staff's evaluation of RAI 4.3-2, as documented in SER Section 4.3.1.2, discusses why this transient is not applicable to the applicant, why it does not need to be monitored by the Fatigue Monitoring Program, and why it does not contribute to fatigue usage of the HPI nozzles. The applicant stated that fatigue usage due to transient 22 was eliminated, and the usage factor contributions from the other NSSS transients were not changed for the EAF calculations.

Based on its review and the evaluation of RAI 4.3-2 in SER Section 4.3.1.2, the staff finds the conservatism removed by the applicant for the stainless steel HPI nozzle safe end EAF evaluation acceptable because the fatigue usage contribution from a test transient, which cannot occur at the applicant's site due to its plant-specific operating parameters, was removed from the evaluation. Additionally, the applicant's Fatigue Monitoring Program will ensure that this evaluation remains valid and the design Code limit of 1.0 is not exceeded during the period of extended operation.

The applicant stated that the RV inlet nozzle, RV outlet nozzle, pressurizer surge nozzle safe end, and HPI/makeup nozzle safe end are the only locations where selected 60-year transient projections were used to reduce the CUFs.

The staff finds the applicant's response acceptable because, for each EAF evaluation in which incremental fatigue contribution was reduced, the applicant provided an adequate justification for the conservatism that was removed, as described above. Additionally, the applicant confirmed that no CUF value of other components was reduced based on selected 60-year transient projections, and the Fatigue Monitoring Program tracks allowable cycles to ensure that these EAF evaluations remain valid during the period of extended operation. The staff's concern described in RAI 4.3-16 is resolved.

LRA Section 4.3.4.2 states that the surge line piping and HPI/makeup nozzle and safe end were evaluated using an integrated F_{en} approach consistent with EPRI Technical Report MRP-47;

however, EPRI Technical Report MRP-47 has not been reviewed and approved by the NRC. The staff noted that, in Technical Report MRP-47, Section 4.2, the CUF and U_{en} are computed for each load pair, and an effective F_{en} is calculated by dividing the U_{en} by the CUF. LRA Section 4.3.4 states that the maximum U_{en} is calculated with a global F_{en} and the adjusted CUF is then obtained by dividing the U_{en} by the global F_{en}. Furthermore, Footnote 2 of LRA Table 4.3-2 states that the global F_{en} is calculated using the method from Section 4.2 of Technical Report MRP-47. However, the staff noted that the term "global F_{en}" was not discussed in Technical Report MRP-47, and the process of calculating the global F_{en} was not addressed in the LRA. Therefore, it is not clear how the applicant determined the U_{en} for the surge line piping and the HPI/makeup nozzle and safe end. By letter dated May 2, 2011, the staff issued RAI 4.3-17 asking the applicant to justify that the use of the integrated F_{en} approach in Technical Report MRP-47 is applicable and adequately conservative to calculate U_{en} for the period of extended operation. The staff also asked the applicant to clarify how the "global F_{en}" is calculated for each component and provide its relationship with the U_{en} calculation methodology discussed in TR MRP-47.

In its response to RAI 4.3-17 dated June 17, 2011, the applicant stated the EAF evaluation of the stainless steel surge line involved calculation of a separate F_{en} multiplier for each transient pair in the analysis. A value for the F_{en} value was computed using the worst-case strain rate of less than 0.0004 percent per second, dissolved oxygen content of less than 0.05 parts per million (ppm), and the appropriate temperature associated with each transient. The applicant stated that the 60-year projected numbers of NSSS design cycles in LRA Table 4.3-1 were used (except for the best estimate 60-year project cycles of 114 for HU/CD events), and the transient pairings were performed in accordance with ASME Code, Section III, rules. The applicant explained that the U_{en} for each transient pair is determined by multiplying the in-air CUF for that pair by the F_{en} calculated for that pair. The cumulative U_{en} for that specific location is obtained by adding up the U_{en} contribution for all transient pairs and the "global F_{en}" is then calculated by dividing the cumulative U_{en} by the total in-air CUF.

The staff determined that the dissolved oxygen concentration assumption is conservative for the F_{en} formulation of stainless steel materials because assuming a higher dissolved oxygen content results in a lower and less conservative F_{en} value. The staff determined the applicant's strain-rate assumption is conservative for the F_{en} formulation of stainless steel materials because assuming a higher strain rate results in a lower and less conservative F_{en} value.

The staff held a teleconference with the applicant on July 12, 2011, to discuss LRA Section 4.3.4.2 and Footnote 2 of LRA Table 4.3-2, which states that the adjusted CUF is obtained by dividing the U_{en} by the global F_{en}. By letter dated August 17, 2011, the applicant revised LRA Table 4.3-2 and LRA Section 4.3.4.2. Specifically, Footnote 2 of LRA Table 4.3-2 and LRA Section 4.3.4.2 was revised to state that, for the pressurizer surge line, the adjusted CUF was calculated using 60-year projected cycles (except for best-estimate 60-year project cycles of 114 used for HU/CD events). In addition, Footnote 9 was added to LRA Table 4.3-2 to describe the methods used by the applicant to determine the F_{en}, the U_{en}, and global F_{en}. The staff's review of the applicant's response to RAI 4.3-19 discusses the use of the best-estimate 60-year projected cycles of 114 used for HU/CD events for the EAF evaluation of the pressurizer surge line, which is documented below in SER Section 4.3.4.2. The staff's review of the applicant's assumptions in determining the F_{en} value is documented previously in SER Section 4.3.4.2.

In its response to RAI 4.3-17 dated June 17, 2011, the applicant also stated that the EAF evaluation of the stainless steel HPI/makeup nozzle safe end involved calculating the F_{en} value with an integrated approach at different temperatures and an overall F_{en} was obtained over the entire temperature range considered. The integrated F_{en} value was determined for each transient event that is applicable to the HPI nozzle safe end and was then applied to the incremental CUF associated with each transient. Since the U_{en} for this component was 4.417, the applicant committed in the LRA (Commitment No. 23) to replace all four HPI/makeup nozzle safe ends prior to the period of extended operation.

The staff noted that the integrated F_{en} approach, which computes F_{en} value over the entire range of temperature, gives a more refined F_{en} value to account for the environmental effects of reactor coolant on component fatigue life. The staff noted that the surge line piping and HPI/makeup nozzle EAF evaluations were dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), where the effects of EAF will be managed by the Fatigue Monitoring Program. The Fatigue Monitoring Program, as amended by letter dated June 3, 2011, states that it prevents the EAF evaluations from becoming invalid by assuring that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0, including environmental effects where applicable. The staff's evaluation of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant's response, as amended by letter dated August 17, 2011, acceptable for the following reasons:

- The applicant conservatively calculated the F_{en} values, as described above, in the surge line piping EAF evaluation.
- The applicant performed a rigorous integrated F_{en} calculation to obtain more refined F_{en} values for the transients used in the HPI/makeup nozzle EAF evaluation.
- The applicant's EAF evaluations for the surge line piping and HPI/makeup nozzle have been dispositioned in accordance with 10 CFR 54.21(c)(1)(iii) and managed with the Fatigue Monitoring Program, which counts transient cycles to ensure that allowable cycle limits used in these EAF evaluations and the Code design limit of 1.0 are not exceeded.

The staff's concern described in RAI 4.3-17 is resolved.

The applicant committed (Commitment No. 23) to evaluate the environmental effects on the replacement HPI nozzle safe ends and associated welds in accordance with NUREG/CR-6260 and the guidance of EPRI TR MRP-47, Revision 1. The staff noted that EPRI Technical Report MRP-47 has not been reviewed and approved by the NRC, and the applicant does not specify which portions of MRP-47 will be used in this evaluation of the replacement HPI nozzle safe ends and associated welds. The staff noted that the applicant claims that its Fatigue Monitoring Program, with enhancements, is consistent with GALL Report AMPX.M1 and that it addresses the effects of the reactor coolant environment on component fatigue life. By letter dated May 2, 2011, the staff issued RAI 4.3-18 asking the applicant to justify the use of EPRI Technical Report MRP-47 to evaluate the environmental effects on the replacement HPI nozzle safe ends and associated welds in lieu of managing cumulative fatigue damage as part of the Fatigue Monitoring Program, which is consistent with the recommendations of the GALL Report AMP X.M1.

In its response dated June 17, 2011, the applicant stated that it used Section 4.2 of Technical Report MRP-47 in the EAF calculations because there is no specific NRC guidance provided for the application of F_{en} factors, reported in NUREG/CR-5704, to an ASME Code fatigue evaluation. The applicant committed (Commitment No. 23), as amended by letter dated October 31, 2011, to replace the HPI nozzle safe end including the associated Alloy 82/182 weld for all four HPI nozzles prior to the period of extended operation. The applicant also amended Commitment No. 23 to credit the Fatigue Monitoring Program to evaluate the environmental effects and manage cumulative fatigue damage for the replacement HPI nozzle safe ends and associated welds. The Fatigue Monitoring Program, as amended by letter dated June 3, 2011, states that it prevents the fatigue TLAAs (i.e., EAF evaluations) from becoming invalid by assuring that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0, including environmental effects where applicable. By letter dated October 31, 2011, the applicant stated that the Inservice Inspection Program has been augmented to include examination of the HPI/makeup nozzle thermal sleeves. In addition, the thermal sleeve for this nozzle has since been replaced during the Cycle 13 RFO that ended in March 2004 and the Inservice Inspection Program was revised to require an augmented VT-1 visual examination of the makeup nozzle thermal sleeve once every other RFO commencing with the Cycle 15 RFO. The staff's evaluation of the Fatigue Monitoring Program and Inservice Inspection Program are documented in SER Sections 3.0.3.2.6 and 3.0.3.1.12, respectively.

The staff finds the applicant's response acceptable because the applicant committed to replace the HPI nozzle safe ends prior to the period of extended operation. Additionally, the applicant credited its Fatigue Monitoring Program to manage cumulative fatigue damage on the replacement HPI nozzle safe ends and associated welds, including environmental effects, by ensuring the evaluation remains valid and Code design limit of 1.0 is not exceeded during the period of extended operation, which is consistent with the recommendations of GALL Report AMP X.M1. In addition, the staff finds acceptable the applicant plans to inspect the HPI/makeup nozzle thermal sleeves as part of its Inservice Inspection Program. The staff's concern described in RAI 4.3-18 is resolved.

LRA Section 4.3.4.2 states that the EAF evaluation for the stainless steel surge line piping used 60-year projected cycle with the exception of the 60-year projection of HU/CD in which a best estimate number of 114 cycles were used. The staff noted that LRA Table 4.3-1 states that the 60-year projected cycles for HUs/CDs are 128 cycles, which is based on the linear extrapolation method described in the LRA Section 4.3.1.2. The applicant committed (Commitment No. 9) to monitor any transient where the 60-year projected cycles were used in an EAF evaluation and establish an administrative limit that is equal to or less than the 60-year projected cycles. In this particular evaluation, for the stainless steel surge line piping, the analyzed number of cycles for the HU/CD transients is less than the 60-year projected cycle. By letter dated May 2, 2011, the staff issued RAI 4.3-19 requesting the applicant provide the basis for using 114 HU/CD transient cycles in the EAF evaluation and justify that the Fatigue Monitoring Program and Commitment No. 9 will ensure that corrective actions will be taken prior to the HU/CD transients exceeding the analyzed number of cycles of 114. The staff also asked the applicant to clarify whether there are any additional locations in which the analyzed transient cycles are less than the 60-year projected cycles listed in LRA Table 4.3-1.

In its response dated June 17, 2011, the applicant stated that it was not able to demonstrate in its EAF evaluation that the surge line piping was acceptable for 60 years of operation when it used the 60-year projected HU/CD cycles (128 cycles for each transient), which are provided in LRA Table 4.3-1. The applicant stated that, alternatively, it used the best-estimate 60-year projected cycles for the HU/CD cycles, which is based on more recent operating experience compared to the entire operation history of the plant. This resulted in a best-estimate 60-year projected cycles of 114 cycles for the HU/CD transients. The applicant clarified that all of its EAF evaluations used the 60-year projected cycles reported in LRA Table 4.3-1 with the exception of the surge line piping EAF evaluations that used the best estimate 60-year projected HU/CD cycles. The staff noted that the surge line piping EAF evaluation was dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), where the effects of reactor coolant environment on component fatigue life will be managed by the Fatigue Monitoring Program. The Fatigue Monitoring Program, as amended by letter dated June 3, 2011, states that it prevents the fatigue TLAAs from becoming invalid by assuring that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0, including environmental effects where applicable. The staff's evaluation of the Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff finds the applicant's response acceptable because the applicant's EAF evaluations, including the surge line piping, have been dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), such that the effects of cumulative fatigue damage when considering reactor water environment will be managed by the Fatigue Monitoring Program. This program counts transient cycles to ensure that the allowable cycle limits (e.g., 128 cycles or 114 cycles) used in the EAF evaluations and the Code design limit of 1.0 are not exceeded during the period of extended operation. The staff's concern described in RAI 4.3-19 is resolved.

In its review of LRA Section 4.3.4.2, the staff noted that F_{en} values were determined using guidance contained in NUREG/CR-6583 for carbon and low-alloy steels and in NUREG/CR-6909 for Ni-based alloys. The applicant stated that the calculated bounding values for F_{en} are 1.74 for carbon steel, 2.45 for low-alloy steel, and 4.16 for the Ni alloy incore instrument nozzles. Based on the guidance in NUREG/CR-6583 and NUREG/CR-6909, the F_{en} value can vary based on sulfur content, temperature, dissolved oxygen content, and strain rate. The staff noted that for Ni-based alloy components, when using the guidance in NUREG/CR-6909, the F_{en} value can be as high as 4.52. For carbon and low-alloy steel components, when using the guidance in NUREG/CR-6583, the F_{en} value can vary significantly depending on the plant's history for dissolved oxygen content in the reactor coolant. It is not clear to the staff what assumptions were used by the applicant when determining the bounding F_{en} values for the carbon and low-alloy steel and Ni-based alloy components described in LRA Section 4.3.4.2 and LRA Table 4.3-2.

By letter dated May 2, 2011, the staff issued RAI 4.3-21 asking the applicant to clarify how the bounding F_{en} values for carbon steel, low-alloy steel, and Ni-based alloy components were determined and to justify any assumptions used. Furthermore, specifically for carbon and low-alloy steel components, the applicant was requested to confirm that dissolved oxygen content remained less than 0.05 ppm since initial plant operation and justify that the dissolved oxygen content will remain less than 0.05 ppm during the period of extended operation.

In its response dated June 17, 2011, the applicant stated that the bounding F_{en} value for carbon steel and low-alloy steel were calculated from NUREG/CR-6583, equations 6.5a and 6.5b, respectively. In addition, the applicant stated that, in a PWR environment, the dissolved oxygen level is less than 0.05 ppm at RCS temperatures greater than 302 °F (150 °C); therefore, at this RCS temperature, the transformed dissolved oxygen is 0.0, and the bounding F_{en} values for carbon steel and low alloy steel are 1.74 and 2.45, respectively. The staff reviewed NUREG/CR-6583 and confirmed that, at RCS temperatures below 150 °C, the transformed metal service temperature in equations 6.5a and 6.5b is 0.0, and the bounding F_{en} values for carbon steel and low alloy steel are 1.74 and 2.45, respectively.

The applicant stated that NUREG/CR-6909 was used to determine the F_{en} value for the Ni-based alloy incore instrument nozzles. This evaluation assumed that the temperature of the incore instrument nozzles is 582 °F (305.6 °C), which corresponds to the average RCS temperature at 15 percent power for steady-state operations, as defined in the applicant's RCS functional specification. The applicant stated that, at 15 percent power, the RV inlet and outlet temperature are approximately 577 °F and 586 °F, respectively, with an average temperature of 582 °F. As power increases, the reactor inlet temperature decreases to 556.5 °F at full power. The staff noted that, during normal operation at full power, the average temperature between the RV inlet and outlet will be less than the assumed average temperature of 582 °F for the incore instrument nozzles in the EAF evaluation. The staff finds this assumption of 582 °F for the average temperature acceptable because it is conservative to assume a higher temperature, as an input to determine the transformed temperature value, when calculating the F_{en} value for Ni-based alloy components. Consistent with NUREG/CR-6909, the applicant stated that it used a conservative transformed temperature value, as described above, the bounding strain rate of 0.0004 percent per second and transformed dissolved oxygen content of 0.16 for PWR water.

The applicant confirmed that dissolved oxygen in the RCS has been historically less than 0.05 ppm with RCS temperatures greater than 302 °F (150 °C), and the only exceptions are short periods of time during selected heat-ups when the pressurizer temperature was elevated to approximately 425 °F, with the RCS temperature at approximately 100 °F. The applicant further explained the circumstances in which the dissolved oxygen content exceeds 0.05 ppm and determined that, in order to meet the dissolved oxygen requirements, a method of adding hydrazine directly to the pressurizer was needed. The applicant described the method that it would take to meet the meet dissolved oxygen content requirements and stated that the method was successfully employed during pressurizer heatup following February 2010 cycle 16 RFO.

The applicant stated that through the use of hydrazine addition, the sampling frequency and dissolved oxygen limits specified in its PWR Water Chemistry Program, it provides assurance that reactor coolant dissolved oxygen levels will continue to be maintained below 0.05 ppm at temperatures above 250 °F for the period of extended operation. The staff finds that the short periods of time when the dissolved oxygen levels exceeded 0.05 ppm do not have a significant impact to the overall F_{en} value because the duration of time that the plant operated in this manner is negligible when compared to the total operating time after 60 years with dissolved oxygen less than 0.05 ppm, and the resultant increase in F_{en} value is also negligible. The staff noted that dissolved oxygen content at temperatures less than 302 °F (150 °C) does not have an impact on the F_{en} value, based on the guidance provided in NUREG/CR-6583. This is only applicable for carbon and low-alloy steel components because the assumption of dissolved oxygen less than 0.05 ppm is conservative and bounding for calculating the F_{en} value for stainless steel components.

The staff finds the applicant's response acceptable for the following reasons:

- The applicant provided adequate justification for the assumptions made in determining F_{en} factors for carbon steel, low-alloy steel, and Ni-based alloy components, which the staff confirmed were bounding based on the operating parameters of these components.
- The applicant confirmed that it has historically maintained dissolved oxygen content to less than 0.05 ppm, except as justified above.
- The applicant will continue to maintain its primary water chemistry and dissolved oxygen content less than 0.05 ppm during the period of extended operation.

The staff's concern described in RAI 4.3-21 is resolved.

Based on its review, the staff finds the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of reactor coolant environment on component fatigue life will be adequately managed for the period of extended operation. Additionally, the applicant has met the acceptance criteria in SRP-LR, Revision 2, Section 4.3.2.1.3 because it has demonstrated that the impact of the reactor coolant environment on critical components has been adequately addressed and will be managed by the Fatigue Monitoring Program, such that the applicant's EAF evaluations will remain valid. Additionally, the Design Code limit of 1.0 will not be exceeded during the period of extended operation or corrective actions will be taken.

4.3.4.3 USAR Supplement

LRA Section A.2.3.4.2 provides the USAR supplement summarizing the effects of the reactor coolant environment on fatigue life of piping and components. The staff reviewed LRA Section A.2.3.4.2 consistent with the review procedures in SRP-LR Section 4.3.3.3, which state that the review verifies that the applicant has provided information, to be included in the USAR supplement that includes a summary description of the evaluation of the effects of reactor coolant environment on fatigue life. The SRP-LR also states that the reviewer should verify that the applicant identified and committed in the LRA to any future aging management activities, including enhancements and commitments to be completed before the period of extended operation.

The staff noted that, based on the discussions regarding the staff's concern in RAI 4.3-18, the applicant revised Commitment No. 23 in its letter dated June 17, 2011, as amended by letter dated October 31, 2011, to state the following:

> In association with the TLAA for effects of environmentally assisted fatigue of the high pressure injection (HPI) nozzle safe end including the associated Alloy 82/182 weld (weld that connects the safe end to the nozzle), replace the HPI nozzle safe end including the associated Alloy 82/182 weld for all four HPI nozzles prior to the period of extended operation. The Fatigue Monitoring Program will evaluate the environmental effects and manage cumulative fatigue damage for the replacement high pressure injection (HPI) nozzle safe ends and associated welds.

The staff's evaluation of RAI 4.3-18 is documented in SER Section 4.3.4.2.

Based on its review of the USAR supplement, the staff finds that the USAR supplement meets the acceptance criteria in SRP-LR Section 4.3.2.3. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the effects of reactor coolant environment on component fatigue life, as required by 10 CFR 54.21(d).

4.3.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant's evaluations on the effects of the reactor coolant environment on component fatigue life is not a TLAA, as defined by 10 CFR 54.3(a), and consistent with Commission Order No. CLI-10-17. The staff also concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of reactor coolant environment on component fatigue life will be adequately managed for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the evaluation, as required by 10 CFR 54.21(d).

4.4 <u>Environmental Qualification of Electrical Equipment</u>

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4 describes the applicant's TLAA for the evaluation of environmentally qualified electrical equipment for the period of extended operation. The applicant stated that environmentally qualified components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the limits established in the evaluation. The applicant also stated that equipment qualification evaluations for environmentally qualified components that specify a qualification of at least 40 years are considered TLAAs for license renewal.

The applicant dispositioned the EQ of Electrical Components Program TLAA in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed LRA Section 4.4 on the TLAA associated with the EQ of Electrical Components Program to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation. The staff's review of the EQ of Electrical Components Program is documented in SER Section 3.0.3.1.7.

The EQ requirements established by 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49 specifically require each applicant to establish a program to qualify electrical equipment so that such equipment, in its end-of-life condition, will meet its performance specifications during and following design basis accidents. The 10 CFR 50.49 EQ Program is a TLAA for purposes of license renewal. The TLAA of the EQ of electrical components includes all long-lived, passive, and active electrical and instrumentation and control (I&C) components that are important to safety and are located in a harsh environment. The harsh environments of the plant are those areas subject to environmental effects by a LOCA, HELB, or post-LOCA environment. EQ equipment comprises safety-related and nonsafety-related equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ electrical equipment. The applicant shall demonstrate one of the following for each type of EQ equipment:

- The analyses remain valid for the period of extended operation.
- The analyses have been projected to the end of the period of extended operation.
- The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.4.3.1.3, which state that, pursuant to 10 CFR 54.21(c)(1)(iii), an applicant must demonstrate that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff reviewed LRA Sections 4.4 and B.2.14, plant basis documents, additional information provided to the staff, and interviewed plant personnel to verify whether the applicant provided adequate information to meet the requirement of 10 CFR 54.21(c)(1). For electrical equipment, the applicant uses 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that the aging effects of EQ equipment will be adequately managed during the period of extended operation. Per the GALL Report, plant EQ Programs that implement the requirements of 10 CFR 50.49 are considered acceptable AMPs under license renewal 10 CFR 54.21(c)(1)(iii). GALL Report AMP X.E1, "Environmental Qualification (EQ) of Electric Components," provides a means to meet the requirements of 10 CFR 54.21(c)(1)(iii). The staff reviewed the applicant's EQ Program to determine 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, pursuant to 10 CFR 50.49. The staff conducted an audit of the information provided in LRA Sections 4.4 and B.2.14 and the program basis documents. LRA Section B.2.14 discusses the component reanalysis attributes, including analytical models, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions. On the basis of its audit, the staff finds that the EQ Program, which the applicant claimed to be consistent with GALL Report AMP X.E1, "Environment Qualification (EQ) of Electric Components," is consistent with the GALL Report, as described in SER Section 3.0.3.1.7. Therefore, the staff concludes that the applicant's EQ of Electric Equipment TLAA is implemented per the requirements of 10 CFR 54.21(c)(1)(iii).

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions of the EQ of electric equipment TLAA will be adequately managed for the period of extended operation. Additionally, the applicant's disposition of this TLAA meets the acceptance criteria in SRP-LR Section 4.4.2.1.3 because the applicant's EQ Program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal. The continued implementation of the EQ Program provides assurance that the aging effects will be managed and that components within the scope of the EQ Program will continue to perform their intended functions for the period of extended operation.

4.4.3 USAR Supplement

LRA Section A.2.4 provides the USAR supplement summarizing the EQ of Electrical Equipment TLAA. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.4.3.3, which state that the detailed information on the evaluation of TLAAs is contained in the renewal application. A summary description of the evaluation of TLAAs for the period of extended operation is contained in the applicant's USAR supplement.

Based on its review of the USAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.4.2.3. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for the period of extended operation, as required by 10 CFR 54.21(d).

4.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions of the EQ of electrical equipment will be adequately managed for the period of extended operation. 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).

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 and LRA Tables 4.1-1 and 4.1-2 state that the concrete containment tendon pre-stress analysis is not a TLAA. The LRA states that the containment is a cylindrical steel pressure vessel with hemispherical dome and ellipsoidal bottom, which is completely enclosed by a reinforced concrete shield building, and an annular space is provided between the wall of the containment vessel and the wall of the shield building. The applicant stated that the TLAA for tendon prestress is not applicable because the plant has a free-standing metal containment.

4.5.2 Staff Evaluation

The staff noted that SRP-LR Table 4.1-2 states that the concrete containment tendon analyses may be a generic TLAA applicable under an applicant's CLB. The staff reviewed relevant containment design information in the USAR to evaluate the validity of the applicant's basis. The staff noted that USAR Section 3.8.2 identifies the containment as a cylindrical steel pressure vessel that is enclosed by a reinforced concrete shield building, with annular space between the two buildings. The staff also noted that USAR Section 1.2.10 describes the containment vessel as a free-standing steel structure housed within a concrete shield building that has no structural ties with the containment vessel, other than the concrete foundation slab upon which the containment vessel is built. Thus, the staff confirmed that the containment does not use a pre-stressed concrete design, and does not use prestressed or preloaded tendons as the basis for structural reinforcement.

Based on its review, the staff confirmed that the design of the containment structure is not reinforced with pre-stressed tendons; therefore, the staff finds that this TLAA is not required. The staff also references its evaluation in SER Section 3.5.2.2.1.5, "Loss of Prestress due to Relaxation, Shrinkage, Creep and Elevated Temperature."

4.5.3 USAR Supplement

The staff concludes that no USAR supplement is required because the applicant has no pre-stressed tendons in its containment.

4.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that this TLAA is not required.

4.6 Containment Fatigue Analyses

LRA Section 4.6 provides the assessment of containment fatigue as a TLAA for Davis-Besse license renewal. The applicant's assessment is documented in the following major subsections of LRA Section 4.6:

- LRA Section 4.6.1—Containment Vessel
- LRA Section 4.6.2—Containment Penetrations

- LRA Section 4.6.3—Permanent Canal Seal Plate

4.6.1 Containment Vessel

4.6.1.1 Summary of Technical Information in the Application

LRA Section 4.6.1 describes the applicant's evaluation of the TLAA for the containment vessel. The applicant stated that the containment vessel is a cylindrical steel pressure vessel with hemispherical dome and ellipsoidal bottom, which houses the RV, reactor coolant piping, pressurizer, pressurizer quench tank and coolers, RCPs, SGs, core flooding tanks, letdown coolers, and normal ventilating system. The LRA states that the containment vessel is a Class B vessel, as defined in the ASME Code, Section III, paragraph N-132, 1968 edition through summer 1969 addenda.

The LRA states that the containment vessel meets the requirements of ASME Code, Section III, paragraph N-415.1, thereby justifying the exclusion of cyclic or fatigue analyses in the design of the containment vessel. The LRA also stated that analysis of 400 pressure cycles (from -25 to 120 psi) and 400 temperature cycles (from 30 °F to 120 °F) were performed against the requirements of ASME Code, Section III, paragraph N-415.1. The LRA further states that, to date, the containment vessel has not seen any pressure cycles from -25 to 120 psi. The LRA further states that the values of 400 pressure and temperature cycles used to exclude fatigue analyses will not be exceeded for 60 years of operation.

The applicant dispositioned the containment vessel TLAA in accordance with 10 CFR 54.21(c)(1)(i), that the TLAA excluding the containment vessel from fatigue analysis remains valid during the period of extended operation.

4.6.1.2 Staff Evaluation

The staff reviewed LRA Section 4.6.1 and the containment vessel TLAA to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis remains valid during the period of extended operation. The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.6.3.1.1.1, which state that the number of assumed transients used in the existing CUF calculations for the current operating term is compared to the extrapolation to 60 years of operation of the number of operating transients experienced to date. This comparison confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

The staff reviewed the applicant's USAR Section 3.8.2.1.5 which states that the containment vessel design meets the requirements for paragraph N-415.1, Section III of the 1968 ASME Code, Section III, to justify the exclusion of cyclic or fatigue analyses.

The LRA states that the containment vessel was analyzed for 400 temperature cycles (from 30 °F to 120 °F) and 400 pressure cycles (from -25 to 120 psi) against the requirements for ASME Code, Section III, paragraph N-415.1 fatigue waiver. For the temperature cycles, the staff noted in USAR Section 3.8.2.1.4(e) that the containment is designed to a lowest metal service temperature of 30 °F and a maximum operating temperature of 120 °F. However, the staff could not determine the basis for a pressure range of -25 to 120 psi in the applicant's USAR. In addition, the staff noted that the USAR does not specify how and when the analysis used to satisfy the fatigue waiver was performed, nor does it address the 400 pressure and 400 temperature cycles used in a fatigue analysis. Therefore, by letter dated July 21, 2011, the staff issued RAI 4.6-1 requesting that the applicant describe the original design basis used to determine that the requirements of a fatigue waiver, per ASME Code, subparagraph N-415.1, were met for the containment vessel.

In its response dated August 17, 2011, the applicant stated that the fatigue waiver calculation for the containment vessel was performed in accordance with paragraphs N-415.1(a) through (f) of ASME Code, Section III. The applicant further stated that the calculation confirmed the requirements of N-415.1 for 400 pressure cycles (from -25 to 20 psi) and 400 temperature cycles (from 30 °F to 120 °F) and provided calculations to justify the basis for their determination. The applicant stated that although the pressure cycle range used in the fatigue waiver evaluation is from -25 to 20 psi, for a full range pressure fluctuation of 45 psi, the possible full range pressure is from -0.67 to 45 psig based on the containment vessel design allowable values. The applicant stated that this adjusted full range pressure fluctuation of 45.67 psig still meets the criteria of ASME Code, subparagraph N 415.1(b).

The staff reviewed the applicant's August 17, 2011, response and determined that additional information was needed to complete its review. The staff determined that the applicant's response to RAI 4.6-1 had not provided the basis for using 400 pressure and temperature cycles. In addition, the staff noted that, in its response to RAI 4.6-1, the applicant stated that it had used a pressure range of -25 to 20 psi in the fatigue analysis, which differed from the -25 to 120 psi stated in the LRA. In a teleconference held on September 13, 2011, the staff requested the applicant provide a supplement to the response for RAI 4.6-1 to include the basis for the 400 pressure and temperature cycles and resolve the discrepancy in pressure ranges between the RAI response and the LRA.

In a letter dated October 7, 2011, the applicant submitted a supplemental RAI response that revised the LRA to include details of its fatigue waiver analysis, provided the basis for using 400 cycles, and revised the error in the LRA. The applicant stated that the 400 cycles in the original fatigue analysis were based on a conservative estimate of anticipated cycles for 40 years of operation. The staff reviewed USAR Table 5.1-8 and noted that the original plant design was for 240 HU/CD cycles. The staff also reviewed LRA Table 4.3-1, which provided an updated analysis of transient cycles. LRA Table 4.3-1 shows that the plant is projected to reach 128 cycles through 60 years of operation. The staff noted that the analysis of 400 temperature cycles performed against the requirements of ASME Code, Section III, paragraph N-415.1, for the fatigue waiver is greater than the plant design number of transients for 40 years of operation and is also greater than the projected number of cycles anticipated through the period of extended operation. The staff finds this acceptable because the number of transients in the existing analyses will not be exceeded during the period of extended operation.

In its October 7, 2011, response letter, the applicant stated that the pressure range of -25 to 120 psi in the original LRA submittal was a typographical error, and the LRA should have read -25 to 20 psi. However, the applicant stated that the pressure range considered in the original fatigue analysis has since been replaced with the adjusted pressure range of -0.67 to 45 psig, which is based on the containment vessel design allowable negative pressure of -0.67 psig and the containment vessel pneumatic test pressure of 45 psig (design pressure of 36 psig x 1.25). The applicant re-performed their fatigue waiver calculation with the corrected values and determined that the adjusted pressure range did not exceed ASME Code requirements. The staff found that the pressure range of -0.67 psig to 45 psig provided in the supplemental RAI response is consistent with the design pressures stated in USAR Section 3.8.2.1.4(e) for the containment vessel. However, the staff could not determine the applicant's basis for having used a pressure range of -25 to 20 psi in the original fatigue waiver calculation, when that analysis was revised, and the basis for the change.

In a telephone conference held on October 26, 2011, the staff requested that the applicant explain the original basis for the pressure range of -25 to 20 psi used in the original fatigue waiver. By letter dated November 9, 2011, the applicant stated that based on a review of their CLB, the basis for the pressure range of -25 psi to 20 psi could not be determined. Therefore, the applicant re-performed the fatigue waiver with the values for the maximum possible full range pressure fluctuation in the containment vessel design. The staff found this acceptable because the analysis uses the design pressure range found in the USAR and is within the limits of the ASME Code requirements for the fatigue waiver. The staff's concern described in RAI 4.6-1 is resolved.

The staff reviewed USAR Section 3.7.3 to determine if the fatigue analysis for the containment vessel considered earthquake-induced cycles. The staff noted in USAR Section 3.7.3.1 that the applicant's earthquake analysis conservatively assumes 200 cycles of significant loading for Class 1 structures. The USAR states that the design criteria for both structures and equipment required that the calculated stresses from seismic, combined with other loads, remained below yield of the material. The USAR further states that since the calculated stresses were below yield, no cyclic loading was considered in the design, and for the small number of cycles that occur during an earthquake, fatigue modes of failure are not applicable for structures and equipment. The staff finds it acceptable that earthquake-induced cycles are not a part of the applicant's fatigue analysis for the containment vessel because the applicant's CLB does not include consideration of seismic stresses in the design of the containment vessel.

The staff finds that the TLAA for the containment vessel meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of projected cycles remains below the original design assumptions and the number of cycles used in the fatigue waiver analysis. As such, the existing exemption from fatigue analysis for the containment vessel will remain valid for the period of extended operation. The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis exemption for the containment vessel remains valid during the period of extended operation.

4.6.1.3 USAR Supplement

LRA Section A.2.5.1 provides the USAR supplement summarizing the containment vessel TLAA. The staff reviewed LRA Section A.2.5.1 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the applicant should provide a summary description of the fatigue evaluation of the containment vessel including the basis for determining that the applicant has dispositioned the evaluation in accordance with 10 CFR 54.21(c)(1).

Based on its review of the USAR supplement, as amended by letter dated August 17, 2011, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the containment vessel fatigue analysis, as required by 10 CFR 54.21(d).

4.6.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the containment vessel TLAA remains valid during the period of extended operation. 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).

4.6.2 Containment Penetrations

4.6.2.1 Summary of Technical Information in the Application

LRA Section 4.6.2 describes the applicant's evaluation of the existence of a TLAA for the containment penetrations. The applicant stated that the piping penetrations (of the containment vessel) are either large diameter, high energy, hot piping (main steam and feedwater lines), or small diameter lower energy piping (general piping). The applicant also stated that each main steam and main feedwater containment penetration consists of a process pipe, a guard pipe, a flued head, and a penetration bellows assembly.

The applicant stated that, consistent with the exclusion of cyclic fatigue analyses in containment vessel design (reviewed by the staff in SER Section 4.6.1), a search of the Davis-Besse CLB did not identify any pressurization cycles or fatigue analyses for containment penetration assemblies. Therefore, the applicant stated that there are no TLAAs associated with the containment vessel penetrations.

4.6.2.2 Staff Evaluation

The staff reviewed LRA Section 4.6.2 and the applicant's CLB to verify that there is no TLAA for containment penetrations, in accordance with the definition of a TLAA in 10 CFR 54.3. Section 54.3(a) of 10 CFR states, in part, that a TLAA must involve time-limited assumptions defined by the current operating term. The staff reviewed the applicant's USAR Section 3.8.2.1.3 and noted that the containment vessel, including the penetrations, was designed using the ASME Boiler and Pressure Vessel Code, Section III, 1968 through summer addenda 1969. ASME Code, Section III, Paragraph N-451, "General Requirements for Openings," part (a) states, in part, that "for vessels or parts thereof which meet the requirements of N-415.1, analysis showing satisfaction of the (fatigue analysis) requirements of N-414.1, N-414.2, N-414.3, and N-414.4 in the immediate vicinity of the openings is not required. The staff reviewed and confirmed the applicability of the provisions of ASME Code, Section N-415.1, for the containment vessel in SER Section 4.6.1. In addition, the staff noted that the applicant's review and an independent staff review did not identify any cycle-dependent analysis for containment penetrations. The staff finds the applicant's determination that there is no TLAA associated with the containment vessel penetrations acceptable because the analysis does not satisfy criterion (3) of the definition of a TLAA given by 10 CFR 54.3, that there must be time-limited assumptions defined by the current operating term.

4.6.2.3 USAR Supplement

LRA Section A.2.5.2 provides the USAR supplement, which states that there is no TLAA associated with the containment vessel penetrations. The staff reviewed LRA Section A.2.5.2 consistent with the review procedures in SRP-LR Section 4.1.3, which state that the staff should verify that the analysis does not meet at least one of the criteria defining a TLAA in 10 CFR 54.3.

Based on its review of the USAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.1.2. Additionally, the staff determines that the applicant provided an adequate summary description of the lack of a TLAA for containment penetrations in accordance with the 10 CFR 54.3 definition of TLAA, as required by 10 CFR 54.21(d).

4.6.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration that there is no TLAA for containment penetrations. The staff also concludes that the USAR supplement contains an appropriate summary of the evaluation for a TLAA, as required by 10 CFR 54.21(d).

4.6.3 Permanent Canal Seal Plate

4.6.3.1 Summary of Technical Information in the Application

LRA Section 4.6.3 describes the applicant's evaluation of the TLAA for the permanent canal seal plate (also known as the permanent reactor cavity seal plate). The applicant also stated that the permanent canal seal plate spans the gap between the RV and the fuel transfer canal floor and retains water in the canal when the canal is flooded. The applicant further stated that the fatigue analysis of the permanent canal seal plate seal membrane, which was installed in 2004, shows that the maximum fatigue usage factor, at the inner leg to the RV seal ledge weld, is based on 50 full HU/CD cycles. In LRA Table 4.3-1, transient 31A, the permanent canal seal plate is projected to experience 51 HU/CD cycles through the end of the period of extended operation.

The applicant stated that the number of occurrences of permanent canal seal plate HU/CD is tracked by the Fatigue Monitoring Program to ensure that action is taken before the analyzed number of transients is reached. The applicant dispositioned the permanent canal seal plate TLAA in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

4.6.3.2 Staff Evaluation

The staff reviewed LRA Section 4.6.3 and the permanent canal seal plate TLAA to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function of the permanent canal seal plate will be adequately managed for the period of extended operation. The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.6.3.1.1.3, which state that, if the proposed AMP relies on mitigation or inspection, it shall be evaluated against the 10 elements described in BTP RLSB-1 of Appendix A of the SRP-LR. If the applicant proposes a component replacement before its CUF exceeds 1.0, the CUF for the replacement will remain less than or equal to 1.0 during the period of extended operation.

The staff reviewed the applicant's statement that the permanent canal seal plate membrane was designed to 50 HU/CD cycles and that the design for 50 cycles corresponds to the maximum CUF based on the fatigue properties of the materials and expected fatigue service of the membrane. The staff searched the applicant's USAR and did not find a statement showing that 50 cycles was used in the original fatigue analysis. The staff needed more information to complete its review; therefore, by letter dated July 21, 2011, as Part 2 of RAI 4.6-1, the staff requested that the applicant explain the basis for the 50 cycles stated in the LRA.

By letter dated August 17, 2011, the applicant responded that the actual maximum fatigue usage factor for the permanent canal seal plate, which is at the inner leg to the RV seal ledge weld, has a value of 1.2, based on 60 cycles. The applicant stated that to satisfy the ASME Code requirement that the maximum usage factor not exceed 1.0, the number of HU/CD cycles is established at 50 cycles. The staff could not determine whether the applicant performed the ASME Code Division III analysis for 50 cycles and calculated a CUF of less than 1.0 or if the 50 cycles was a linear extrapolation from 60 cycles with CUF of 1.2. In a September 13, 2011, telephone conference, the staff asked the applicant to confirm that they performed the ASME Code Division III fatigue analysis for 50 cycles and calculated a CUF which did not exceed 1.0. The applicant stated that the analysis was performed for 50 cycles, with a CUF of 1.0. The staff finds this acceptable because the applicant confirmed that 50 cycles was used for the fatigue analysis of the permanent canal seal plate. The staff's concern in Part 2 of RAI 4.6-1 is resolved.

The staff noted that, in accordance with LRA Table 4.3-1, transient 31A, the permanent canal seal plate was installed on January 25, 2003, and it is expected to exceed the anticipated number of HU/CD cycles during the period of extended operation. As of February 19, 2008, the permanent canal seal plate has experienced 7.5 HU/CD cycles and a 60-year projection anticipates the component will experience a total of 51 cycles, which is greater than the allowed 50 cycles. The applicant is using the Fatigue Monitoring Program to track the number of HU/CD cycles experienced by the permanent canal seal plate. The staff noted that the applicant's Fatigue Monitoring Program is based on tracking transient cycle counts and comparing them with design limits on fatigue transients to manage cumulative fatigue damage of select components. The staff's review of the applicant's Fatigue Monitoring Program is located in Section 3.0.3.2.6 of this SER. The Fatigue Monitoring Program has measures to ensure that fatigue usage calculations are updated, as needed, prior to the accrued cycles exceeding the allowable cycle limit, which meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.3.

The staff finds the use of the Fatigue Monitoring Program acceptable because the program will track the transients analyzed in the design of the permanent canal seal membrane, and it will implement appropriate actions to maintain the CUF of the permanent canal seal plate with allowable limits through the period of extended operation.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions of the permanent canal seal plate will be adequately managed for the period of extended operation.

4.6.3.3 USAR Supplement

LRA Section A.2.5.3 provides the USAR supplement summarizing the permanent canal seal plate TLAA. Based on its review of the USAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the effects of aging on the intended functions will be adequately managed for the period of extended operation for the permanent canal seal plate TLAA, as required by 10 CFR 54.21(d).

4.6.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions of the permanent canal seal plate will be adequately managed for the period of extended operation. 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).

4.7 Other Plant-Specific Time-Limited Aging Analyses

4.7.1 Leak-Before-Break

LRA Section 4.7.1 provides the background for the applicant's use of leak-before-break (LBB). The use of LBB is based on the plant's ability to detect leakage from a through-wall flaw in piping and take appropriate action before the flaw could grow to the point of failure. Topical report BAW-1847, Revision 1, "Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSS," September 1985 (ADAMS Accession Nos. 8511180489 and 8511180499), presents the LBB evaluations of primary coolant system piping in several B&W plants, including the 36-in. hot leg and 28-in. cold leg piping at Davis-Besse. The inputs to the LBB analyses include RCS piping structural loads, leakage flaw size determination, and RCS piping material properties.

In 2010, in accordance with NRC approval, the applicant installed at Davis-Besse, nickel-based Alloy 52 weld overlays on the Alloy 82/182 dissimilar metal welds (DMWs) at the RCP suction and discharge nozzles to mitigate primary water stress corrosion cracking (PWSCC). The RCP nozzles are part of piping approved for LBB. As part of the weld overlay installation, the applicant updated its original LBB evaluation to reflect the new weld configuration with the weld overlays in place.

The applicant evaluated the TLAA for use of LBB in terms of the fatigue flaw growth analysis in LRA Section 4.7.1.1, the thermal aging analyses for CASS in LRA Section 4.7.1.2, and the PWSCC analyses in LRA Section 4.7.1.3.

4.7.1.1 Fatigue Flaw Growth

4.7.1.1.1 Summary of Technical Information in the Application

LRA Section 4.7.1.1 describes the applicant's TLAA for fatigue flaw growth in the LBB evaluation. As part of the LBB analysis, the applicant postulated surface flaws at the piping system locations having the highest stress coincident with the lower bound of the material properties for base metal and welds. The applicant calculated growth due to fatigue for a postulated surface flaw to demonstrate that should the surface flaw propagate in the through-wall direction, an identifiable leak would develop and the operator would take corrective actions before the flaw would propagate circumferentially around the pipe and cause a double-ended pipe rupture under faulted conditions.

The applicant used plant design transients in the fatigue flaw growth analysis. For the updated analysis, the applicant used 1.5 times the design cycles for the RCP suction and discharge weld overlays. The applicant stated that the transient cycles are being monitored by the Fatigue Monitoring Program. The applicant also stated that if a transient cycle count approaches the allowable design limit, corrective actions will be taken. The applicant further stated that the effects of fatigue flaw growth on piping approved for LBB will be managed by the Fatigue Monitoring Program for the period of extended operation.

The applicant dispositioned the TLAAs for the fatigue flaw growth analysis in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging will be adequately managed for the period of extended operation.

4.7.1.1.2 Staff Evaluation

The staff reviewed LRA Section 4.7.1.1 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging will be adequately managed for the period of extended operation. The staff reviewed the applicant's TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.7.3, which state that the review of the TLAA provides assurance that the aging effects are properly addressed through the period of extended operation.

By letter dated March 21, 2011, the staff issued RAI 4.7.1.1-3, requesting the applicant to explain the differences among the updated analysis, the fatigue flaw growth analysis, and the LBB analysis, as discussed in LRA Section 4.7.1.1. In its response, dated April 20, 2011, the applicant stated that the original LBB evaluation for the Davis-Besse RCS primary piping is contained in Topical Report BAW-1847, Revision 1. The applicant stated that the original LBB evaluation included fatigue flaw growth analyses, flaw stability analyses, and limit load analyses. The NRC approved the original LBB evaluation in BAW-1847, Revision 1, by letter dated December 12, 1985, from Dennis M. Crutchfield, NRC to L.C. Oakes, B&WOG, Subject "Safety Evaluation of B&W Group Reports Dealing with Elimination of Postulated Pipe Breaks in PWER Primary Main Loop."

By letter dated September 28, 2009, the applicant submitted the updated LBB evaluation "License Amendment Request to Update the Leak-Before-Break Evaluation for the Reactor Coolant Pump Suction and Discharge Nozzle Dissimilar Metal Welds," (ADAMS Accession No. ML092790438). The updated LBB evaluation was submitted to address application of weld overlays on the Alloy 82/182 DMWs of the RCP suction and discharge nozzles. As part of the updated LBB evaluation, the applicant analyzed fatigue crack growth for the Alloy 82/182 DMWs to demonstrate that the post-weld overlay crack growth is minimal for balance of plant life.

By letter dated March 24, 2010, the NRC approved the updated LBB evaluation in Amendment No. 281, from Michael Mahoney of NRC to Barry S. Allen of FENOC, "Davis-Besse Nuclear Power Station, Unit 1—Issuance of Amendment RE: Application to update the Leak-Before-Break Evaluation for the Reactor Coolant Pump Suction and Discharge Nozzle Dissimilar Metal Welds" (ADAMS Accession No. ML100640506).

The staff finds that both the original LBB evaluation and updated LBB evaluation include fatigue crack growth calculations. The staff finds the applicant's response to RAI 4.7.1.1-3 acceptable because the applicant has clarified the differences among the updated analysis, the fatigue flaw growth analysis, and the LBB analysis. The staff's concern described in RAI 4.7.1.1-3 is resolved.

The staff evaluated the applicant's original and updated fatigue crack growth calculations in terms of TLAA parameters (e.g., the number of transient cycles) as follows. By letter dated March 21, 2011, the staff issued RAI 4.7.1.1-1, requesting the applicant to provide details of the original fatigue flaw growth analysis, such as the number of postulated surface flaws, initial and final flaw sizes, the plant design transients, and the number of the transient cycles.

In letter dated April 20, 2011, in response to RAI 4.7.1.1-1, the applicant stated that BAW-1847, Revision 1, included fatigue flaw growth analyses for the smallest and largest pipe straight sections to demonstrate that postulated surface flaws are likely to propagate in the through-wall direction and develop leakage before they will propagate circumferentially around the pipe and result in pipe failure. A fatigue flaw in the longitudinal and circumferential direction was postulated for each diameter of the pipe. The minimum postulated flaws are all at least 30 percent through-wall.

The applicant's postulated fatigue flaw sizes that grow through-wall are many times larger than those permitted by the ASME Code. The applicant noted that whether or not the flaws grow through-wall does not affect the conclusion of the LBB evaluation because the LBB methodology allows the pipe to leak. The important factor is that postulated flaws would propagate radially, go through-wall, and produce leakage before they could propagate circumferentially and potentially produce pipe failure.

The applicant stated that six categories of NSSS design transients were used in the fatigue flaw growth evaluation, as shown in Tables 4-3, 4-4, and 4-5 of BAW-1847, Revision 1. Category 1 includes deadweight, thermal expansion, and operating pressure associated with 240 HU/CD cycles. Categories 2 to 5 include thermal stresses due to four groupings of NSSS design transients. Category 6 includes 22 safe shutdown earthquake events. The applicant selected the generic NSSS design transients used in the BAW-1847, Revision 1, to bound the participating B&W plants (including Davis-Besse) for a 28-in. cold leg straight section and a 38-in. hot leg section.

The applicant provided a comparison of the NSSS design cycles used in the fatigue crack growth evaluation in BAW-1847, Revision 1, to the Davis-Besse plant-specific NSSS design cycles. The staff finds that the analyzed cycles used in the original LBB fatigue flaw growth analysis bound the projected transient cycles at the end of 60 years.

In BAW-1847, Revision 1, the fatigue flaw growth analysis was based on linear elastic fracture mechanics and used the equations in Appendix A to Section XI of the ASME Code. This method is applicable to surface flaws that have not fully penetrated the wall. Results of the fatigue flaw growth analysis show the minimum surface flaw depths (semi-elliptical shape) that will grow through the pipe wall. In letter dated April 20, 2011, in response to RAI 4.7.1.1-1, the applicant stated that the analyzed cycles used in the LBB fatigue flaw growth analysis bound the 60 year projected cycles. The staff has confirmed that the applicant has shown that the fatigue flaw growth calculation of LBB piping in the original LBB evaluation used transient cycle numbers that exceed the projected design cycles at the end of 60 years. Therefore, the fatigue flaw growth calculation in the original LBB evaluation is valid for the period of extended operation. The staff's concern described in RAI 4.7.1.1-1 is resolved.

By letter dated March 21, 2011, the staff issued RAI 4.7.1.1-2, which asked the applicant to clarify the fatigue crack growth calculation in the updated LBB evaluation. Specifically, the staff asked about the design cycles and associated cycle numbers, whether the multiple of 1.5 times the design cycles is adequate for the period of extended operation, and how many years the design cycles will cover. In its response, dated April 20, 2011, the applicant stated that, as part of the updated LBB evaluation, it analyzed the fatigue crack growth for the overlaid Alloy 82/182 DMWs using transient cycles that were 1.5 times higher than the 40-year design cycles to bound the 60-year projected cycles. The applicant stated that the analyzed cycles used in the fatigue crack growth analyses would remain valid for at least 90 years of operation, based on current cycle projections.

The staff finds the applicant's response acceptable because the applicant demonstrated that the transient cycles that were used in the fatigue crack growth calculation in the updated LBB evaluation exceed the projected transient cycles at the end of 60 years. Therefore, the fatigue flaw growth analysis in the updated LBB evaluation is valid for the period of extended operation. The staff's concern described in RAI 4.7.1.1-2 is resolved.

LRA Section 4.7.1.1 states that, per 10 CFR 54.21(c)(1)(iii), the effects of fatigue flaw growth on piping approved for LBB will be managed by the Fatigue Monitoring Program for the period of extended operation. By letter dated March 21, 2011, the staff issued RAI 4.7.1.1-4, which asked the applicant to describe the processes and procedures to explain how the actual transient cycles are monitored and how corrective actions will be implemented by the Fatigue Monitoring Program. In its response, dated April 20, 2011, the applicant stated that it has elected to disposition the fatigue flaw growth analysis in accordance with 10 CFR 54.21(c)(1)(i), instead of 10 CFR 54.21(c)(1)(iii), as stated in LRA Section 4.7.1.1. The applicant further stated that it will not credit the Fatigue Monitoring Program for managing the effects of fatigue flaw growth on piping approved for LBB. The applicant explained that it compared the design cycles that were used in the original fatigue flaw growth evaluation for LBB piping provided in BAW-1847, Revision 1, to the Davis-Besse 60-year projected cycles and determined that the analyzed cycles bound the 60-year projected cycles. The applicant further stated that the fatigue flaw growth calculation in the original LBB evaluation remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). The staff finds the applicant's response acceptable for the following reasons:

- The staff confirmed that the transient cycles used in the original LBB evaluation bound the projected 60-year transient cycles.
- The staff compared the design cycles that were used in the fatigue crack growth analyses for the Alloy 82/182 DMWs in the updated LBB evaluation to the 60-year projected cycles and confirmed that the analyzed cycles bound the 60-year projected cycles.
- The staff finds that the fatigue crack growth analysis in the updated LBB evaluation remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

Therefore, the staff's concern described in RAI 4.7.1.1-4 is resolved.

As shown in the enclosure to the April 20, 2011, letter, LRA Amendment 4 revised LRA Section 4.7.1.1 to disposition the fatigue crack growth calculations of LBB piping pursuant to 10 CFR 54.21(c)(1)(i).

The staff reviewed the applicant's revised disposition of this TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.1, which state that justification provided by the applicant is reviewed to verify that the existing analyses are valid for the period of extended operation and the existing analyses should be shown to be bounding even during the period of extended operation. The staff finds the revision to LRA Section 4.7.1.1 acceptable because the staff has confirmed that the existing fatigue flaw growth analyses in the original and updated LBB evaluations are valid for the period of extended operation and the transient cycles used in the LBB evaluations bound the projected 60-year transient cycles.

4.7.1.1.3 USAR Supplement

LRA Section A.2.7.1 provides the USAR supplement summarizing the TLAA evaluation of the fatigue flaw growth calculation for LBB piping. The applicant amended LRA Section A.2.7.1 to include its response to RAIs 4.7.1.1-1 and 4.7.1.1-2, as documented in LRA Amendment 4 (April 20, 2011). The staff reviewed the amended LRA Section A.2.7.1 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the staff verifies that the USAR supplement includes a summary description of the evaluation of each TLAA.

Based on its review of the revised USAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.7.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA of the fatigue flaw growth calculation for LBB piping, as required by 10 CFR 54.21(d).

4.7.1.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue crack growth analyses for the LBB piping will remain valid for the period of extended operation. The staff also concludes that the amended USAR supplement contains an appropriate summary description of the fatigue crack growth analyses for the LBB piping, as required by 10 CFR 54.21(d).

4.7.1.2 Thermal Aging

4.7.1.2.1 Summary of Technical Information in the Application

LRA Section 4.7.1.2 states that the only stainless steel components in the LBB analysis are the safe ends welded to the RCP casings and the pump casings themselves, with the pump casings being the only cast stainless steel. The RCP casings at Davis-Besse, including the suction and discharge nozzles, are made of annealed SA 351 CF-8M and were statically cast.

The applicant stated that the updated LBB analysis was based on saturated embrittlement of the CASS casings, such that there is no embrittlement TLAA. The applicant also stated that reduction of fracture toughness due to thermal embrittlement of CASS components is an aging effect requiring management for the RCP casings and is managed by the ISI Program. The applicant further stated that the acceptability of a 10-year inspection interval for these weld overlays was demonstrated in the updated LBB analysis. The applicant also stated that this analysis does not justify operation of the weld overlays for the life of the plant but for the 10 years between inspections. Therefore, the effects of thermal aging on CASS components in the approved LBB piping will be managed by the ISI Program for the period of extended operation.

The applicant stated that thermal aging of CASS is not a TLAA. The effects of thermal aging on CASS components in the approved LBB piping will be managed by the ISI Program for the period of extended operation.

4.7.1.2.2 Staff Evaluation

The staff confirmed, pursuant to 10 CFR 54.3, that the analysis of thermal aging of CASS related to LBB is not a TLAA for the period of extended operation.

The staff reviewed the applicant’s evaluation and conclusion consistent with the review procedures in SRP-LR Section 4.1.3, which state that the reviewer verifies that the selected analyses do not meet at least one of the six criteria of a TLAA, as defined in 10 CFR 54.3(a).

By letter dated March 21, 2011, the staff issued RAI 4.7.1.2-1, requesting the applicant to explain why thermal aging of CASS component is not a TLAA if it is monitored by the ISI Program, as stated in LRA Section 4.7.1.2. In its response dated April 20, 2011, the applicant stated that thermal aging of CASS components (i.e., RCP casings including the pump suction and discharge nozzles) in the LBB piping is not a TLAA because saturated embrittlement (the lowest and worst-case fracture toughness) was used in the updated LBB analysis, and thus 10 CFR 54.21(c)(1)(iii) is not applicable.

By letter dated March 21, 2011, the staff issued RAI 4.7.1.2-4, requesting the applicant to demonstrate that the value of fracture toughness used in the updated LBB analysis represents the lowest and worst-case fracture toughness value for the RCP casing. In its response dated April 20, 2011, the applicant stated that the updated LBB analysis used actual material properties to develop lower bound J-R curves and J_{Ic}/K_{Ic} for the RCP pump CASS material heats with consideration of thermal embrittlement.

The applicant used the lowest (saturated) fracture toughness property of the CASS material, which bounds the fracture toughness value at the end of 60 years, and, thereby, has demonstrated that the structural integrity of the CASS components will be acceptable at the end of 60 years. SER Section 4.7.6.2 discusses in detail the staff's evaluation of the fracture toughness value used in the applicant's pump casing analysis. The staff notes that the applicant has addressed the staff's concern regarding thermal embrittlement of CASS satisfactorily because the LBB evaluation has considered the thermal embrittlement of CASS using the worst case fracture toughness of the LBB piping, and the LBB piping has satisfied the safety margins in SRP-LR Section 3.6.3. The staff's concerns described in RAI 4.7.1.2-1 and RAI 4.7.1.2-4 are resolved.

As part of its response to RAI 4.7.1.2-1, the applicant proposed in LRA amendment No. 4 to delete the following two sentences from LRA Section 4.7.1.2 and the associated TLAA summary in Section A.2.7.1: "The acceptability of a 10 year inspection interval for these weld overlays was demonstrated in the updated LBB analysis. This analysis does not justify operation of the weld overlays for the life of the plant, but for the 10 years between inspections…" The proposed deletion to LRA Section 4.7.1.2 is documented in the enclosure to the April 20, 2011, letter. The staff finds the proposed revision to LRA Section 4.7.1.2 acceptable for two reasons: 1) the staff found the inspection and analysis of the subject weld overlays acceptable in its March 24, 2010, SE on the updated LBB in accordance with the requirements of 10 CFR Part 50, and 2) deletion of these two sentences does not affect the staff's evaluation of whether the weld overlay analysis is a TLAA.

The staff is not aware of any ultrasonic examination technique that has been qualified to detect flaws in CASS material in accordance with the ASME Code, Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems." By letter dated March 20, 2011, the staff issued RAI 4.7.1.2-2, which asked the applicant to discuss the ASME Code-qualified ISI method(s) that will be used to monitor thermal aging effect in the CASS components and the associated inspection frequency. In its response dated April 20, 2011, the applicant stated that the primary inspection of CASS components (i.e., valve bodies and pump casings) is external visual examination. Internal visual inspections and volumetric inspections are performed only when a valve or pump is disassembled for maintenance. The applicant stated that the GALL Report, Section XI.M12 (the CASS AMP), states that screening for susceptibility to thermal aging is not required for pump casings and valve bodies based on the assessment documented in the letter dated May 19, 2000, from Christopher Grimes, NRC, to Douglas Walters, NEI. GALL Report AMP XI.M12 further states that the existing ASME Code, Section XI, inspection requirements, including the alternative requirements of ASME Code Case N-481 for pump casings, are adequate for all pump casings and valve bodies.

For pump casings, the applicant stated that ASME Code, Section XI, ISI requirements for pressure retaining welds of pump casings (Examination Category B-L-I) are delineated in ASME Code, Section XI, Table IWB-2500-1. The applicant stated that Examination Category B-L-1 requires volumetric examination of pump casing welds. The applicant stated that Davis-Besse uses ASME Code Case N-481 in lieu of the examination requirements of this Code category. The applicant also stated that these alternate requirements consist of visual inspections and an analytical evaluation to demonstrate the safety and serviceability of the pump casings in the presence of an assumed flaw and that each of the four RCP casings is visually examined every 10-year ISI interval.

For valve bodies, the applicant stated that there are no ASME Code Category B-M-1 welds in valves installed at Davis-Besse and there are 10 Code Category B-M-2 valves in four groups. The applicant stated that one valve per group will be examined over each ISI interval when disassembled for routine maintenance, repair, or volumetric examination. The applicant also stated that, per ASME Code, Section XI, Table IWB-2500-1, item B.12.30, the inspection of Code Category B-M-2 valves less than 4-in. NPS is limited to surface examination. The applicant further stated that per ASME Code, Section XI, Table IWB-2500-1, items B.12.40 and B.12.50, the inspection of valves greater than 4-in. NPS includes volumetric and visual (VT-3) examination. However, the inspection is limited to an external visual (VT-3) inspection unless the valve is opened for maintenance and repair. Therefore, the staff finds that it is acceptable that Davis-Besse will inspect the CASS pump casings and valves per the ASME Code, Section XI, Table IWB-2500-1. The staff's concern described in RAI 4.7.1.2-2 is resolved. SER Section 4.7.6 provides additional information and the staff's review regarding Code Case N-481.

By letter dated March 20, 2011, the staff issued RAI 4.7.1.2-3 requesting the applicant to explain why the LRA does not include an AMP to monitor thermal aging embrittlement of CASS that is similar to GALL Report AMP XI.M12. In letter dated April 20, 2011, the applicant stated that the LRA does not include a Thermal Aging Embrittlement of CASS Program similar to GALL Report AMP XI.M12 because Davis-Besse has no CASS components other than pump casings and valve bodies subject to thermal embrittlement. The applicant further stated that a program similar to GALL Report AMP XI.M12 is not required as reduction of fracture toughness of these component types is managed by the ISI Program, as shown in LRA Section B.2.24.

The applicant noted that GALL Report AMP XI.M12 specifically exempts pump casings and valve bodies from this program and states the following:

> For pump casings and valve bodies, based on the assessment documented in the letter dated May 19, 2000 from Christopher Grimes, Nuclear Regulatory Commission (NRC), to Douglas Walters, Nuclear Energy Institute (NEI), screening for susceptibility to thermal aging embrittlement is not required. The existing ASME [Code] Section XI inspection requirements, including the alternative requirements of ASME Code Case N-481 for pump casings, are adequate for all pump casings and valve bodies.

The applicant explained that this position is re-iterated in the GALL Report, item IV.C2-6, which states the following:

> For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary. The ASME [Code] Section XI inspection requirements are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings and valve bodies. Alternatively, the requirements of ASME Code Case N-481 for pump casings are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings.

Also, in response to RAI 4.7.1.2-1, the applicant noted that LRA Table 3.1.1, item 3.1.1-55, shows that the ISI Program is credited with management of thermal aging for CASS components. The applicant stated that this is consistent with SRP-LR Table 3.1-1, which identifies the following under "Aging Management Program": "Inservice [I]nspection (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."

The applicant noted, in response to RAI 4.7.1.2-3, that LRA Table 3.1.2-3 for the RCPB shows only three CASS component types managed for reduction of fracture toughness—RCP casings (Row 196), small bore valve bodies (Row 234), and large bore valve bodies (Row 255). The applicant further stated that, as there are no piping, piping components, or piping elements, other than pump casings and valve bodies, GALL Report AMP XI.M12 is not required.

Based on the review of the applicant's response, the LRA, and the USAR, the staff finds that Davis-Besse has no piping, piping components, or piping elements that are fabricated with CASS other than pump casings, valve bodies, and valve components. GALL Report AMP XI.M12 exempts pump casings and valve bodies from monitoring. Therefore, the staff finds that it is acceptable that Davis-Besse does not implement an AMP to monitor thermal aging of the CASS material. The staff finds it is acceptable that, in lieu of GALL Report AMP XI.M12, CASS pump casings and valve bodies will be examined under the ISI requirements of the ASME Code Section XI. The staff's concern described in RAI 4.7.1.2-3 is resolved.

Based on its review of the information provided by the applicant, the staff finds that the analysis of thermal aging of CASS within its LBB analyses is not a TLAA because it does not meet criterion 3 of the 10 CFR 54.3 definition of a TLAA, which states that the analysis involves "time-limited assumptions defined by the current operating term, for example 40 years."

4.7.1.2.3 USAR Supplement

LRA Section A.2.7.1 provides the USAR supplement summarizing the absence of TLAAs for thermal aging of CASS components in LBB piping. The applicant amended LRA Section A.2.7.1, as documented in LRA Amendment 4 (April 20, 2011). The staff reviewed amended LRA Section A.2.7.1 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the staff verifies that the USAR supplement includes a summary description of the evaluation of each TLAA. Based on its review of the USAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.7.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the absence of TLAA for thermal aging of CASS components in LBB piping, as required by 10 CFR 54.21(d).

4.7.1.2.4 Conclusion

On the basis of its review, the staff concludes that, in accordance with 10 CFR 54.3(a)(3), thermal aging of RCP pump casing is not a TLAA because the fracture toughness value used in the RCP pump casing analysis does not involve time-limited assumptions defined by the current operating term. The staff also concludes that the amended USAR supplement, as shown in April 20, 2011, letter, contains an appropriate summary description of the basis for absence of a TLAA for thermal aging of CASS components, as required by 10 CFR 54.21(d).

4.7.1.3 Primary Water Stress Corrosion Cracking

4.7.1.3.1 Summary of Technical Information in the Application

LRA Section 4.7.1.3 states that the applicant submitted and the NRC approved a relief request to install weld overlays on certain Alloy 600 components and Alloy 82/182 DMWs for mitigation of PWSCC in LBB piping. The applicant updated the original LBB calculations, demonstrating that the weld overlays resolve the concerns for original DMWs susceptibility to PWSCC. The applicant stated that critical crack sizes and leakage rates with the weld overlay in place were evaluated to demonstrate that margins exist for detection of leakage (i.e., the conclusions of the existing LBB analysis remain valid).

The applicant stated that PWSCC is an aging effect requiring management for the period of extended operation and is managed by the ISI Program and the Nickel Alloy Management Program. The applicant further stated that PWSCC is not a TLAA and the effects of PWSCC on the RCS piping will be managed by the ISI Program and the Nickel Alloy Management Program for the period of extended operation.

4.7.1.3.2 Staff Evaluation

The staff reviewed the applicant’s evaluation and conclusion consistent with the review procedures in SRP-LR Section 4.1.3, which state that the reviewer verifies that the selected analyses do not meet at least one of the six criteria of a TLAA, as defined in 10 CFR 54.3(a).

The staff notes that the weld overlay is installed on piping to mitigate PWSCC in nickel-based Alloy 82/182 dissimilar metal welds. By letter dated March 21, 2011, the staff issued RAI 4.7.1.3-1, in which the staff noted that, as part of NRC approval, the design of weld overlays is required to include a fatigue flaw growth calculation based on a postulated or an actual detected flaw in the Alloy 82/182 dissimilar metal weld. The fatigue flaw growth calculation uses transient cycles, which are time dependent. Therefore, as described in SER Section 4.7.1.2.2, the staff found that the fatigue flaw growth calculation in the weld overlay design is a TLAA. However, the staff notes that PWSCC is not a TLAA concern as part of the weld overlay design.

In its response to RAI 4.7.1.3-1 dated April 20, 2011, the applicant stated that it addressed the fatigue flaw growth TLAA for the Alloy 82/182 DMWs at RCP nozzles (in response to RAI 4.7.1.3-1) and provided a revision to LRA Section 4.7.1.1 to include the subject TLAA (LRA Amendment 4). As part of its response to RAI 4.7.1.3-1, the applicant proposed to delete LRA Section 4.7.1.3, as shown in LRA Amendment 4 (April 20, 2011).

The staff finds acceptable the applicant’s proposal to delete LRA Section 4.7.1.3 because PWSCC is not a TLAA, and the revised LRA Section 4.7.1 addresses the issues of PWSCC and weld overlay installation on RCP nozzles. The staff’s concern described in RAI 4.7.1.3-1 is resolved.

4.7.1.3.3 USAR Supplement

LRA Amendment 4 deleted the USAR supplement summary of PWSCC in LBB piping in LRA Section A.2.7.1. The staff finds the deletion acceptable because PWSCC is not a TLAA and resolution of aging effects due to PWSCC is discussed in amended LRA Section 4.7.1.

4.7.1.3.4 Conclusion

LRA Amendment 4 (April 20, 2011) deleted LRA Section 4.7.1.3 and the PWSCC portion of LRA Section A.2.7.1. The staff concludes that the deletion is acceptable because PWSCC is not a TLAA and resolution of aging effects due to PWSCC is discussed in the amended LRA Section 4.7.1.1.

4.7.2 Metal Corrosion Allowance for Pressurizer Instrument Nozzles

4.7.2.1 Summary of Technical Information in the Application

LRA Section 4.7.2 states that USAR Section 5.2.3.2 indicates that pressurizer nozzle repairs and replacements have resulted in a portion of the carbon steel pressurizer nozzle bore being exposed to reactor coolant. The applicant stated that this resulted in an increase of the general corrosion rate (GCR) of the pressurizer shell base metal in the nozzle bores from 0 to 1.42 thousandths of an inch (mils) per year. The applicant also stated that, over the 9 years from the installation of this modification to the end of the original licensed period, general corrosion will result in a loss of 13 mils of the pressurizer carbon steel shell in the nozzle annular regions. The applicant further stated that the allowable radial corrosion limit, calculated per Section III of the ASME Code, is 293 mils for the level instrument nozzles, 493 mils for the sample nozzle, and 495 mils for the vent and thermowell nozzles. The applicant stated that the projected loss of material can be extrapolated to 60-years by multiplying the 1.42 mils per year corrosion rate times the 29 years from the date of installation to the end of the period of extended operation. The applicant further stated that the projected loss of 41.2 mils (29 years x 1.42 mils per year) remains below the allowable radial corrosion limits.

The applicant dispositions the TLAA associated with the metal corrosion allowance for the pressurizer instrument nozzles in accordance with 10 CFR 54.21(c)(1)(ii), that the analysis has been projected to the end of the period of extended operation.

4.7.2.2 Staff Evaluation

The staff reviewed LRA Section 4.7.2 on metal corrosion of the pressurizer instrument nozzles to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the metal corrosion of the pressurizer instrument nozzles has been projected to the end of the period of extended operation. The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state "the documented results of the revised analyses are reviewed to verify that their period of evaluation is extended, such that they are valid for the period of extended operation (e.g., 60 years)."

By letter dated March 21, 2011, the staff issued RAI 4.7.2-1 requesting the applicant to discuss in detail how the corrosion rate was obtained. The staff also asked the applicant to discuss verification of the corrosion rate and to explain whether the corrosion rate increases as the component ages.

In its response dated April 20, 2011, the applicant stated the following:

General Corrosion rate of 1.42 mils per year was developed in Structural Integrity Associates, Inc., Report SIR-07-188-NPS, "Evaluation of the Corrosion of Carbon Steel and Low Alloy Steel in Portions of Pressurizer Vessels Exposed to Primary Water Following Repair of Small Bore Instrument Nozzles," dated November 2007.

All of the repairs of small bore instrument nozzles or other penetrations that expose carbon steel to primary coolant by "uncovering" some carbon steel vessel material will expose that steel to borated water of nominal boron concentrations under immersion conditions rather than conditions of dripping and evaporation that occur for borated water that leaks from the pressure boundary. The corrosion rate methodology, described in Report SIR-07-188-NPS, used the corrosion rates reported from the literature for such worst case full immersion conditions compared to steam at high temperature, low temperature, and very low oxygen environments (e.g., normal operation) or higher oxygen environments that may occur during refueling. The overall metal loss is the sum of the products of the time at given conditions and the corrosion rates for each of those environments. Assuming that [Davis-Besse] operates 85 [percent] of the year at high temperatures, spends 10 [percent] of the year under shutdown conditions and 5 [percent] of the year at intermediate temperatures, the total general corrosion rate (GCR), actually an average annualized metal loss rate, would be the following: GCR = 0.85x0.6 (operated at 500 °F) + 0.1x8 (operated at 100 °F) + 0.05x2.2 (operated at 300 °F) = 1.42 mils per year

The allowable radial corrosion limits, provided in LRA Section 4.7.2, were developed in Structural Integrity Associates, Inc., Calculation Package DB-09Q-303, "Determination of Allowable Corrosion of Pressurizer Vessel Shell," Revision 1, dated November 17, 2007. In this calculation, the maximum allowable corrosion of the pressurizer material in the penetration bore was quantified by determining the corroded radius such that [the] resulting stresses due to primary loads in the repair pad still meet ASME Code, Section III, design conditions allowable values. General primary membrane and primary membrane-plus-bending stress intensity values due to pressure and mechanical loads (where applicable) were determined and compared to ASME Code allowable values using the maximum corroded bore radius that is possible.

For carbon steel and low alloy steel, oxidation of metallic iron to ferrous ion (Fe^{+2}, a soluble ionic species) or ferric ion (Fe^{+3}, an insoluble ion) on the low-alloy steel provides a level of protection against continuing corrosion. Therefore, the general corrosion rate of 1.42 mils per year is an average annualized metal loss rate and is assumed to be constant throughout the remaining life of the plant.

To verify the applicant's corrosion rate, the staff used a Westinghouse topical report as a reference. On January 12, 2005, the staff approved Westinghouse topic report, WCAP-15973-P, Revision 1, "Low-Alloy Steel Component Corrosion Analysis Supporting Small Diameter Alloy 600/690 Nozzle Repair/Replacement Program" (ADAMS Accession No. ML050180528). The corrosion rate of 1.42 mils per year used by Davis-Besse is slightly lower than the corrosion rate specified for Combustion Engineering plants in WCAP-15973-P. Considering the operating and system design differences between the Combustion Engineering plants and B&W plants such as Davis-Besse, the staff finds the slight difference in the GCR acceptable. The staff finds acceptable the applicant's use of 1.42 mils as the corrosion rate, since the corrosion rate equation used is similar to the method found acceptable to the staff in WCAP-15973-P. Based on this finding, the staff's concern described in RAI 4.7.2-1 is resolved.

The staff finds that the applicant's evaluation of this TLAA acceptable because, pursuant to 10 CFR 54.21(c)(1)(ii), the applicant used an adequate corrosion rate to project the corrosion of the low alloy steel of the pressurizer instrument nozzles to the end of period of extended operation. Further, the corrosion at the end of the period of extended operation was within the allowable limits.

4.7.2.3 USAR Supplement

LRA Section A.2.7.2 provides the USAR supplement summarizing the TLAA of the metal corrosion allowance for pressurizer instrument nozzles. The staff reviewed LRA Section A.2.7.2 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the staff verifies that the USAR supplement includes a summary description of the evaluation of each TLAA. Based on its review of the USAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.7.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA of metal corrosion for pressurizer instrument nozzles, as required by 10 CFR 54.21(d).

4.7.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the metal corrosion allowance for pressurizer instrument nozzles has been projected to the end of the period of the extended operation, such that the projected metal loss in the instrument nozzles will be within the allowable limits at the end of the period of extended operation. 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).

4.7.3 Reactor Vessel Thermal Shock due to Borated Water Storage Tank Injection

4.7.3.1 Summary of Technical Information in the Application

LRA Section 4.7.3 describes the applicant's TLAA for RV thermal shock due to postulated BWST injection. The applicant stated that USAR Section 5.2 addresses integrity of the RCPB and the analysis to demonstrate that the RV can safely accommodate the PTS condition that is associated with a postulated small steam line break and subsequent low temperature injection from the BWST by the emergency core cooling system at the end of the RV design life. The applicant stated that this transient generates the greatest level of stress in the RV. The applicant also stated that this analysis was revised for the LRA to use RV embrittlement values that bound the period of extended operation.

The applicant further stated that the integrity of the RV was analyzed for this postulated thermal shock event taking into consideration RV embrittlement through 52 EFPY and the 35 °F minimum temperature for the water in the BWST. Several locations in the RV were analyzed for this postulated thermal shock event, and all locations have demonstrated service life greater than 52 EFPY.

Based on the information above, the applicant concluded that the RV integrity analysis under postulated thermal shock conditions associated with BWST injection has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.3.2 Staff Evaluation

The staff reviewed LRA Section 4.7.3 on postulated RV thermal shock due to BWST injection to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the applicant provided an acceptable analysis for demonstrating that RV integrity will be maintained during the subject thermal shock event considering projected neutron embrittlement for the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.2, which state "the documented results of the revised analyses are reviewed to verify that their period of evaluation is extended, such that they are valid for the period of extended operation (e.g., 60 years)."

The staff reviewed USAR Section 5.2 and could not find information regarding the applicant's analysis for demonstrating that RV integrity will be maintained under the postulated thermal shock conditions associated with BWST injection following a small steam line break. The staff determined that the applicant must provide sufficient information or references for this analysis, taking into consideration embrittlement of the RV beltline materials at 52 EPFY. Therefore, by letter dated October 11, 2011, the staff issued RAI 4.7.3-1 requesting that the applicant state the USAR section and page number where the summary of the CLB analysis of the subject thermal shock event is located and provide the reports or calculations documenting the projected 52 EFPY analysis of RV integrity under the subject postulated thermal shock conditions.

In its response dated October 31, 2011, the applicant addressed the 52 EFPY analysis of RV integrity during the subject thermal shock event and the recent update to USAR Section 5.2 describing this 52 EFPY analysis. In its RAI response, the applicant stated that the analysis is addressed in USAR Section 5.2, pages 5.2-2 and 5.2-3. The applicant stated that the original analysis of the RV for this thermal shock event used a non-conservative water injection temperature for the postulated operation of the emergency core cooling system. The applicant also stated that pages 5.2-2 and 5.2-3 of USAR Section 5.2 were revised on May 26, 2011, under an approved USAR change notice, to address the recent reanalysis of RV integrity under the specific postulated thermal shock condition associated with BWST water injection at 35 °F and RV embrittlement through 52 EFPY, as described in LRA Section 4.7.3. The revisions to USAR Section 5.2 were provided by the applicant as part of its response to RAI 4.7.3-1. The staff reviewed the USAR Section 5.2 revisions and confirmed that USAR Section 5.2 does contain an adequate summary description of the analysis for demonstrating RV integrity under these thermal shock conditions. Furthermore, the staff confirmed that the revision to USAR Section 5.2 also states that this analysis was performed using RV fluence levels corresponding to 52 EFPY.

In its response to RAI 4.7.3-1, the applicant stated that the fracture mechanics analysis for evaluating RV integrity during the subject postulated thermal shock event is documented in AREVA Calculation 32-9124893-001, "DB-1 Pressurized Thermal Shock (PTS) Analysis for 32 and 52 EFPY," dated December 14, 2009. The applicant provided this proprietary report in Enclosure C of its October 31, 2011, response to RAI 4.7.3-1. This report documents a linear elastic fracture mechanics analysis for demonstrating that RV integrity will be maintained during the subject postulated thermal shock event, accounting for RV embrittlement at 32 EFPY and 52 EFPY. This linear elastic fracture mechanics analysis is based on the calculation of applied stress intensity factors for the subject thermal shock transient for postulated shallow inside-diameter flaws ranging in depth from one-fortieth of the wall thickness (1/40T) to 1/4T, in increments of 1/40T (i.e., ten postulated flaws: 1/40T, 2/40T, 3/40T….1/4T). The beltline material fracture toughness property (K_{Ic}) for the initiation of flaw growth is based on the formula in the ASME Code, Section XI, Appendix G, which specifies fracture toughness for the initiation of flaw growth as a function of flaw tip temperature and RT_{NDT}, which must be adjusted for neutron embrittlement. The staff confirmed that the analysis was performed for all beltine locations, and the fracture toughness for each location and postulated flaw depth was calculated using flaw tip temperatures based on the thermal shock transient conditions and adjusted RT_{NDT} (ART) values based on neutron embrittlement for 32 EFPY and 52 EFPY. The staff confirmed that 52 EFPY ART values for each of the postulated flaw depths were calculated using the staff's recommended procedures in RG 1.99, Revision 2. The ART values were also calculated using appropriate input values. Specifically, the initial RT_{NDT}, chemistry factor, and margin term inputs correspond to those found acceptable by the staff in SER Sections 4.2.3 and 4.2.4, and the neutron fluence values at the inner surface of the RV correspond to those found acceptable by the staff in SER Section 4.2.1.

Based on its review of the report, the staff determined that this analysis conclusively demonstrates that none of the postulated flaws would initiate growth under the postulated thermal shock condition associated with a small steam line break, followed by 35 °F water injection from the BWST, accounting for neutron embrittlement of the RV beltline materials at 32 EFPY and 52 EFPY. The staff also determined that the analytical methods and assumptions described in the report are consistent with those described in LRA Section 4.7.3 and USAR Section 5.2, as revised on May 26, 2011, to include a reference to this report.

The staff determined that the applicant's response to RAI 4.7.3-1 is acceptable because the applicant provided the detailed analysis of RV integrity under the subject postulated thermal shock conditions for 52 EFPY and identified the revised USAR Section 5.2 text describing this 52 EFPY analysis. The staff also confirmed that the 52 EFPY RV integrity analysis adequately demonstrates that RV integrity would be maintained during this postulated thermal shock event through the period of extended operation, consistent with the description in LRA Section 4.7.3. Therefore, the staff's concern described in RAI 4.7.3-1 is resolved.

The staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of RV thermal shock due to postulated BWST water injection has been projected to the end of the period of extended operation. Additionally, the staff finds that the applicant's TLAA meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the analysis of RV thermal shock due to postulated BWST water injection has been projected to the end of the period of extended operation.

4.7.3.3 USAR Supplement

LRA Section A.2.7.3 provides the USAR supplement summary description for the TLAA of RV thermal shock due to BWST injection. The staff reviewed the applicant's USAR supplement summary description for this TLAA and determined that it is consistent with the TLAA discussed in LRA Section 4.7.3. The staff also concludes that the information in the USAR is consistent with SRP-LR Section 4.7.3.2. Based on its review of the USAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the RV thermal shock due to BWST injection for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis of RV thermal shock due to postulated BWST water injection has been projected to the end of the period of extended operation. 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).

4.7.4 High-Pressure Injection/Makeup Nozzle Thermal Sleeves

4.7.4.1 Summary of Technical Information in the Application

LRA Section 4.7.4 describes the applicant’s TLAA for the HPI/makeup nozzle thermal sleeves. The applicant stated that during the Cycle 5 RFO a failed thermal sleeve for HPI/makeup nozzle A-1 was discovered. The applicant described its corrective actions, which included assessment and preservation of the structural integrity of the nozzle, which had experienced thermal cycling due to the thermal sleeve failure. The applicant stated that the makeup flow path was re-routed from nozzle A-1 to nozzle A-2 during the Cycle 6 RFO (1990) as one of the corrective actions. The applicant also stated that it performed a fracture mechanics analysis of nozzle thermal sleeve life under various makeup flow cycling conditions, which predicted a lifetime exceeding twenty 18-month operating cycles under the current re-routed makeup flow control conditions.

The applicant stated that accounting for the extended (approximately 2 year) Cycle 13 RFO, the conversion to a 24-month fuel cycle, and the MUR power uprate conditions, the predicted end-of-life for the HPI/makeup nozzle thermal sleeve is approximately 2022, based on the predicted number of makeup thermal cycles. The applicant stated that the current operating license for Davis-Besse expires in April 2017. The applicant committed (Commitment No. 23) to replace all four makeup nozzle thermal sleeves prior to the period of extended operation.

The LRA concludes that cracking of the HPI/makeup thermal sleeves will be managed through the period of extended operation by the Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.4.2 Staff Evaluation

The staff reviewed LRA Section 4.7.4 on the HPI/makeup nozzle thermal sleeves to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the thermal sleeves will be adequately managed for the period of extended operation.

The staff reviewed the applicant’s TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant shall propose to manage the aging effects associated with the TLAA using an AMP in the same manner as described in the IPA in 10 CFR 54.21(a)(3). SRP-LR Section 4.7.3.1.3 also states that the applicable AMP is reviewed to verify that the effects of aging on the intended functions are adequately managed consistent with the CLB for the period of extended operation.

LRA Section 4.7.4 describes the 1990 failure of HPI/makeup nozzle thermal sleeve A-1 and the applicant’s proposal to manage the effects of fatigue on the other HPI/makeup nozzle thermal sleeves during the period of extended operation under the Fatigue Monitoring Program. The staff’s review of the applicant’s Fatigue Monitoring Program is discussed in SER Section 3.0.3.2.6.

The staff noted that LRA Section 4.7.4 states that the HPI/makeup flow path was re-routed from HPI/makeup nozzle A-1 to nozzle A-2 during the Cycle 6 RFO (1990) as one of the corrective actions for the subject failed thermal sleeve discovered during the Cycle 5 RFO. By letter dated March 17, 2011, the staff issued RAI 4.7.4-1, requesting that the applicant state which specific HPI/makeup nozzle thermal sleeves were analyzed, as discussed in LRA Section 4.7.4.

In its RAI response dated April 15, 2011, the applicant stated that the fracture mechanics analysis of thermal sleeve life under various makeup flow cycling conditions was performed to predict the life of the thermal sleeve for the HPI nozzle that is used for both HPI and makeup duty, nozzle A-2. The staff found the applicant's response to RAI 4.7.4-1 acceptable because the applicant confirmed that the analysis predicting thermal sleeve end-of-life in 2022 specifically applied to the thermal sleeve on HPI/makeup nozzle A-2. The staff's concern described in RAI 4.7.4-1 is resolved.

By letter dated March 17, 2011, the staff issued RAI 4.7.4-2 requesting that the applicant provide a reference for the subject thermal sleeve fracture mechanics analysis discussed in LRA Section 4.7.4. The applicant's April 15, 2011, response to RAI 4.7.4-2 stated that a description of the methodology and results of the HPI/makeup nozzle thermal sleeve analysis are provided in SIR-91-047, Revision 0 report, "Fracture Mechanics Evaluation of Davis-Besse HPI/Makeup Nozzle Thermal Sleeve," which had been submitted to the NRC by letter dated August 23, 1991 (ADAMS Accession No. 910903009, Microfiche Document). By SE issued on January 28, 1991 (ADAMS Accession No. 9102140250, Microfiche Document), the staff approved continued operation of Davis-Besse with the HPI/makeup nozzle thermal sleeve installed at that time. As documented in the January 1991 SE, the staff reviewed an earlier (1990) fracture mechanics evaluation for the HPI/makeup nozzle and approved continued operation of the Davis-Besse unit for Cycle 7 and beyond with the installed HPI/makeup nozzle thermal sleeve under the re-routed makeup flow control conditions. As documented in the January 1991 SE, the staff's approval of continued operation of Davis-Besse was based, in part, on the applicant's commitment to perform a subsequent fracture mechanics analysis of the HPI/makeup nozzle thermal sleeve. Accordingly, the SIR-91-047, Revision 0, report is the "subsequent analysis" provided for in the Davis-Besse commitment. The staff found the applicant's response to RAI 4.7.4-2 acceptable because the applicant identified the key reference for the staff, which helped the staff to locate all documents related to this issue. The staff's concern described in RAI 4.7.4-2 is resolved.

From the January 28, 1991, SE, the staff found that the fatigue crack growth part of the fracture mechanics analysis of the HPI/makeup nozzle was based on an assumed 240 startup and shutdown cycles and 80 HPI transient cycles; these cycle counts bound those expected for the period of extended operation. As discussed in the applicant's August 23, 1991, letter, the fracture mechanics analysis of the thermal sleeve predicts a thermal sleeve lifetime exceeding twenty 18-month operating cycles for the nozzle used for both HPI and makeup service under the re-routed makeup flow control conditions. The staff reviewed the description of the methods used for the 1991 fracture mechanics analysis of the HPI/makeup nozzle thermal sleeve used for both HPI and makeup service. The staff determined that the analysis is acceptable for ensuring thermal sleeve functionality through 2022 because the fracture mechanics model used to analyze the HPI/makeup nozzle thermal sleeve is representative of the fracture behavior of the failed thermal sleeve. Furthermore, as discussed in the August 23, 1991, letter, the stress intensity factor calculations were performed based on a postulated initial flaw size in the unflawed sleeve equal to the initial flaw size observed in the metallurgical analysis of the failed sleeve, and account for flaw growth due to fatigue over twenty 18-month operating cycles. Finally, the staff noted that USAR supplement Commitment No. 23 ensures that all HPI/makeup nozzle thermal sleeves will be replaced prior to entering the period of extended operation (April 2017), which is well before the predicted end-of-life for these sleeves.

LRA Section 4.7.4 stated that the effects of fatigue on the HPI/makeup nozzle thermal sleeve will be managed during the period of extended operation under the Fatigue Monitoring Program (LRA Section B.2.16), in accordance with 10 CFR 54.21(c)(1)(iii). The staff reviewed the applicant's Fatigue Monitoring Program (SER Section 3.0.3.2.6) and determined that this program is not acceptable for managing the effects of aging on the HPI/makeup nozzle thermal sleeve. This determination was made because the applicant's Fatigue Monitoring Program is structured to count transient cycles to ensure that the plant's design-basis transient cycles are not exceeded, thereby ensuring that the ASME Code, Section III cumulative fatigue usage limits are not exceeded. The CUF analyses are evaluated as separate TLAAs in LRA Section 4.3. LRA Section 4.3 CUF analyses do not address the growth of preexisting flaws or postulated flaws. The applicant's Fatigue Monitoring Program is not structured to count transient cycles against any analysis that is based upon the growth of preexisting or postulated flaws.

Based on the above concern, by letter dated April 20, 2011, the staff issued RAI B.2.16-7, requesting that the applicant justify the use of cycle counting, as described in the Fatigue Monitoring Program, for the analysis described in LRA Section 4.7.4, without an update to applicable TS requirements and cycle counting procedures, and without enhancements to the applicable Fatigue Monitoring Program Elements. Note that staff evaluation of this RAI response is described in SER Section 3.0.3.2.6.

By letter dated June 3, 2011, the applicant provided a response to RAI B.2.16-7, indicating that the 10 CFR 54.21(c)(1)(iii) disposition and Fatigue Monitoring Program are no longer used for the LRA Section 4.7.4 TLAA of the HPI/makeup nozzle thermal sleeve. In an enclosure to the RAI response, the applicant provided Amendment 8 to the Davis-Besse LRA. LRA Amendment 8 revised the disposition for the analysis of the HPI/makeup nozzle thermal sleeve in LRA Section 4.7.4 from "10 CFR 54.21(c)(1)(iii)" to "Not a TLAA." The Amendment 8 revision of LRA Section 4.7.4 states that "[b]ased on [the USAR supplement] commitment [to replace the subject thermal sleeve], the HPI/Makeup nozzle thermal sleeves are short-lived (not 40-year) parts and therefore this analysis is not a TLAA." The staff found this disposition not acceptable because aging of the subject thermal sleeve, as discussed in LRA Section 4.7.4, results from an aging mechanism that is time-dependent (i.e., it is dependent on the number of transient cycles incurred), consistent with the definition of a TLAA in 10 CFR 54.3.

By letter dated October 11, 2011, the staff issued RAI 4.7.4-1 requesting that the applicant amend LRA Sections 4.1, 4.7.4, and A.2.7.4 to identify HPI/makeup nozzle thermal sleeve aging as a TLAA. The staff also requested, in RAI 4.7.4-1, that the applicant select an appropriate disposition as required by 10 CFR 54.21(c)(1). The staff noted that if the applicant proposes a 10 CFR 54.21(c)(1)(iii) disposition for this analysis, then the applicant should amend LRA Sections 4.7.4 and A.2.7.4 to propose an appropriate AMP for managing the effects of aging on the HPI/makeup nozzle thermal sleeve. The AMP identified in LRA Sections 4.7.4 and A.2.7.4 for a 10 CFR 54.21(c)(1)(iii) disposition of this analysis should ensure that the effects of aging on the subject thermal sleeve will be appropriately managed for the period of extended operation.

In its response dated October 31, 2011, the applicant provided LRA Amendment 21, which revised several interrelated portions of the LRA. First, the applicant revised LRA Sections 4.1 (Table 4.1-1), 4.7.4, and A.2.7.4 to identify HPI/makeup nozzle thermal sleeve aging as a TLAA. The applicant stated that the effects of aging on the HPI/makeup nozzle thermal sleeve will be managed by the ISI Program during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii). Additionally, the applicant revised LRA Section B.2.24, "Inservice Inspection Program," to include augmented examination of the HPI/makeup nozzle thermal sleeve. Finally, the applicant revised LRA Table A-1, Commitment No. 23 in the USAR supplement to delete thermal sleeve replacement as a required action under this commitment.

The staff reviewed the LRA revisions provided in LRA Amendment 21 and noted that LRA Sections 4.1 (Table 4.1-1), 4.7.4, and A.2.7.4 were appropriately revised to identify HPI/makeup nozzle thermal sleeve aging as a TLAA. The staff also noted that LRA Sections 4.7.4 and A.2.7.4, as revised, now identify 10 CFR 54.21(c)(1)(iii) as the disposition for this TLAA and state that the ISI Program will manage the effects of aging on the HPI/makeup nozzle thermal sleeve during the period of extended operation. Furthermore, LRA Section 4.7.4 now states the following:

> [a]fter re-routing the makeup flow path through HPI nozzle A-2, the thermal sleeve for nozzle A-2 has since been replaced during the Cycle 13 refueling outage that ended in March 2004. In addition, the ISI Program was revised to require an augmented VT-1 visual examination of the HPI/makeup nozzle thermal sleeve once every other refueling outage commencing with the cycle 15 RFO.

The staff confirmed that the ISI Program, as described in LRA Amendment 21 Section B.2.24, was augmented to require a VT-1 visual examination of the HPI/makeup nozzle thermal sleeve once every other RFO, corresponding to once every 4 calendar years, commencing with the cycle 15 RFO (2008). Finally, the staff noted that Commitment No. 23 in Table A-1 of the USAR supplement was revised to delete thermal sleeve replacement as a required action under this commitment.

Based on its review of the LRA, as amended in LRA Amendment 21, the staff determined that the applicant's proposal to manage the effects of aging for the HPI/makeup nozzle thermal sleeve using the augmented ISI program is acceptable because the affected HPI/makeup nozzle thermal sleeve (HPI nozzle A-2) was replaced in 2004, and the implementation of a VT-1 visual examination of the HPI/makeup nozzle thermal sleeve once every other RFO will provide for detection of cracking prior to thermal sleeve failure.

In a December 8, 2011, telephone conference call, the staff requested that the applicant clarify why Commitment No. 23 was revised to remove the action to replace the HPI/makeup nozzle thermal sleeve. During the teleconference discussion, the applicant stated that, since the HPI/makeup nozzle thermal sleeve TLAA was dispositioned as required by 10 CFR 54.21(c)(1)(iii) using the augmented ISI Program to manage the effects of aging, the previous commitment to replace the thermal sleeve was determined to be no longer applicable. The applicant noted that the VT-1 examinations every other RFO started during the cycle 15 RFO and will continue during the period of extended operation. The applicant also noted that VT-1 examinations conducted during the cycle 15 RFO found no indications of thermal sleeve cracking. The staff determined that the applicant provided adequate clarification regarding the deletion of the thermal sleeve replacement action from Commitment No. 23. Based on the acceptable LRA revisions provided in LRA Amendment 21, the replacement of the HPI/makeup nozzle (Nozzle A-2) thermal sleeve in 2004, and the clarification provided during the December 8, 2011, teleconference, the staff determined that the applicant's proposal to manage the effects of aging for the HPI/makeup nozzle thermal sleeve using the augmented ISI Program is acceptable. Therefore, the staff's concern described in RAI 4.7.4-1 is resolved.

Based on the above evaluation, the staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the HPI/makeup nozzle thermal sleeve will be adequately managed by the ISI Program for the period of extended operation. Additionally, the staff finds that the applicant's TLAA meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the effects of aging on the intended function will be adequately managed for the period of extended operation.

4.7.4.3 USAR Supplement

LRA Section A.2.7.4, as revised by LRA Amendment 21, provides the USAR supplement summary description for the TLAA of the HPI/makeup nozzle thermal sleeve. The staff reviewed the applicant's USAR supplement summary description for this TLAA and determined that it is consistent with the TLAA discussed in LRA Amendment 21 Section 4.7.4. The staff also concludes that the information in the USAR is consistent with SRP-LR Section 4.7.3.2. Based on its review of the USAR supplement, the staff concludes that the applicant provided an adequate summary description of its evaluation of the HPI/makeup nozzle thermal sleeve for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the HPI/makeup nozzle thermal sleeve will be adequately managed for the period of extended operation. 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) and therefore, is acceptable.

4.7.5 Inservice Inspection—Fracture Mechanics Analyses

The applicant stated that pursuant to 10 CFR 50.55a(g), an ISI Program is required to verify the integrity of ASME Code Class 1, 2, and 3 components. The ASME Code, Section XI, Table IWB-2500-1, requires the use of nondestructive examination techniques to detect and characterize flaws. Flaws detected in Class 1 components during examination are compared to acceptance standards established in the ASME Code, Section XI, IWB-3500. Unacceptable flaws require detailed analyses, repair, or component replacement.

The applicant stated that fracture mechanics analysis requires a prediction of flaw growth for a specific evaluation period. Flaw indications that are determined not to grow beyond acceptance limits during the evaluation period are justified for continued operation. Fracture mechanics analyses performed for the life of the plant are TLAAs that typically involve the same design transient cycle assumptions considered in the CLB.

The applicant performed a search of Davis-Besse ISI reports and docketed correspondence to identify analytical evaluations of ASME Code components. The applicant identified two analyses based, in part, on fracture or fatigue projections, or both, for the current license term. As such, these analyses are identified as TLAAs in LRA Section 4.7.5.

4.7.5.1 Reactor Coolant System Loop 1 Cold Leg Drain Line Weld Overlay Repair

4.7.5.1.1 Summary of Technical Information in the Application

LRA Section 4.7.5.1 describes the full structural weld overlay repair that was performed for an axial indication found on the RCS Loop 1 cold leg drain line nozzle during the Cycle 14 (calendar year 2006) RFO. The applicant stated that the structural weld overlay for the cold leg drain line nozzle was designed consistent with the requirements of ASME Code Case N-504-2, “Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1,” March 12, 1997 and non-mandatory Appendix Q of the ASME Code, Section XI, “Weld Overlay Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping Weldments.” The applicant stated that the weld overlay design was supplemented by additional design considerations specific to the unique nature of the geometry and materials of the subject cold leg drain line nozzle-to-elbow weld.

The applicant stated that the weld overlay was designed as a full structural overlay that assumes the as-found flaw propagates to extend 100 percent through the pipe wall. Therefore, according to the applicant, an analytical evaluation of the as-found flaw was not required.

The applicant stated that a fatigue analysis was performed for the repaired configuration. According to the applicant, the fatigue analysis conservatively assumed cycles for 60 years at 1.5 times the number of original design cycles. The applicant also stated that this analysis is a TLAA because it is based on a specific number of cycles. The applicant further stated that the Fatigue Monitoring Program manages the effects of fatigue on the RCS drain line weld overlay repair by counting the thermal cycles incurred through the period of extended operation.

Based on the information above, the applicant concluded that the effects of fatigue on the subject weld overlay will be appropriately managed the during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.5.1.2 Staff Evaluation

The staff reviewed LRA Section 4.7.5.1 on the analysis of the weld overlay repair for the axial flaw found in the RCS Loop 1 cold leg drain line nozzle-to-elbow weld to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue on the weld overlay will be adequately managed for the period of extended operation.

The staff reviewed the applicant’s TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3, which state that the reviewer should verify the appropriateness of the applicant’s program for monitoring and tracking the number of critical thermal and pressure transients for the selected RCS components. The SRP-LR further states that the reviewer should verify that the applicant identified the appropriate program, as described and evaluated in the GALL Report. Furthermore, the reviewer should also ensure that the applicant’s program contains the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL Report.

The staff reviewed the information provided by the applicant in LRA Section 4.7.5.1 concerning the weld overlay repair for the axial flaw found in the RCS Loop 1 cold leg drain line nozzle-to-elbow weld during the Cycle 14 RFO. The repair of the drain line using a full structural weld overlay was approved by the staff, as documented in its SE dated October 19, 2006 (ADAMS Accession No. ML062440478). From its review of the 2006 SE, the staff determined that the applicant’s description of its weld overlay repair is consistent with the established ASME Code criteria for acceptable weld overlay repairs of an RCS component because the repair was performed in accordance with the criteria specified in ASME Code Case N-504-2 and nonmandatory Appendix Q of the ASME Code, Section XI, and the subject repair was designed as a full structural weld overlay that conservatively assumes that the as-found flaw has propagated 100 percent through the pipe wall.

According to the applicant, the fatigue analysis of the repaired configuration assumed thermal cycles for 60 years of plant operation. The staff needed additional information in order to confirm that the subject weld overlay repair was properly designed and analyzed for 60 years of thermal cycles at 1.5 times the number of original design cycles. Therefore, by letter dated March 17, 2011, the staff issued RAI 4.7.5.1-1 requesting that the applicant provide a reference for the fatigue analysis of the repaired configuration discussed above.

In its response dated April 15, 2011, the applicant provided the requested reference for the design and fatigue analysis of the subject weld overlay repair. The applicant stated that, by letter dated May 22, 2006 (ADAMS Accession No. ML061440282), it submitted a summary of the calculation packages for the weld overlay to support its 10 CFR 50.55a request for alternative to implement the subject weld overlay repair. The fatigue analysis is addressed in Calculation Number DB-06Q-304, "RCS Cold Leg Letdown Line Nozzle Weld Overlay Repair ASME Code, Section III, Evaluation," Revision 1. This calculation summary demonstrates that the fatigue evaluation of the repaired configuration will meet the ASME Code, Section III, Class 1 design acceptance criteria, considering thermal cycles for 60 years of facility operation at 1.5 times the number of original design cycles. The calculation summary also lists several weld overlay design analyses required by ASME Code Case N-504-2, paragraphs F and G, including calculations of the required weld overlay dimensions, finite element models for calculating thermal, mechanical, and residual stresses, and a weld shrinkage analysis. The staff found that the fatigue analysis identified in Calculation Number DB-06Q-304 adequately demonstrated that the subject weld overlay would remain in compliance with the ASME Code, Section III, Class 1 design acceptance criteria for 60 years of operation because the CUF for the weld overlay is less than 1.0. The CUF is based on an assumed number of transient cycles equal to 1.5 times the number of original design cycles, which bounds the number of cycles projected for the period of extended operation.

The staff noted that the applicant credits its Fatigue Monitoring Program as the basis for managing cumulative fatigue damage during the period of extended operation. The applicant's program includes monitoring and tracking the number of critical thermal and pressure transients that are significant contributors to the fatigue usage factor, which involves the systematic counting of transient cycles and the evaluation of operating data to ensure that the allowable cycle limits are not exceeded. The staff also noted that the applicant's program incorporates action limits and acceptance criteria to ensure that corrective actions are taken to prevent the fatigue TLAAs from exceeding their acceptance criteria, and to assure that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0. Consistent with the recommendation of GALL Report AMP X.M1, the staff noted that the cycle-counting activities in the applicant's Fatigue Monitoring Program are an acceptable approach to manage CUF values for RCPB components and are consistent with 10 CFR 54.21(c)(1)(iii). The staff's evaluation of the applicant's Fatigue Monitoring Program is documented in SER Section 3.0.3.2.6.

The staff noted the calculation summary for the design and analysis of the weld overlay also references an ASME Code, Section XI, crack growth analysis for the original flaw. This crack growth analysis is addressed in Calculation Number DB-06Q-307, "Predicting Fatigue Crack

Growth for the DB Unit 1 RCP 1-1 Cold Leg Drain Nozzle With Design Weld Overlay," Revision 0. The Summary of Results for this calculation states, "[c]rack growth is not considered to be a significant factor affecting the weld overlay design based on the compressive stresses present in the nozzle weld due to the presence of the overlay." The staff questioned whether this analysis of fatigue crack growth in the original weld, even if it demonstrates negligible crack growth, should be identified as a TLAA and dispositioned for the period of extended operation, in accordance with 10 CFR 54.21(c)(1). Therefore, in a telephone conference call on June 21, 2012, the staff requested the applicant to provide additional information to address the analysis of crack growth for the period of extended operation. The staff also requested the applicant to appropriately disposition this analysis in accordance with 10 CFR 54.21(c)(1).

By letter dated July 5, 2012, the applicant provided a supplemental response to RAI 4.7.5.1-1, which stated that the crack growth analysis identified in Calculation Number DB-06Q-307 was performed to demonstrate that flaws of the maximum possible initial size "would not grow unacceptably in the nozzle, so as to undermine the basis for the weld overlay." The applicant emphasized that examinations of the nozzle weld did not precisely characterize the through-wall extent or orientation for the flaw, thereby necessitating a full structural weld overlay that assumed the as-found flaw had propagated 100 percent through-wall. However, the applicant stated that supplemental examinations confirmed that the flaw did not extend into the outer two-thirds of the original nozzle weld thickness, thereby indicating a maximum flaw size that is one-third through-wall from the inner surface of the weld. The applicant stated that its analysis considered six different types of flaw propagation paths, based on the maximum initial flaw size of one-third through the original nozzle weld. The applicant further stated that for each of the six types of flaw paths, the maximum and minimum applied stress intensity factors for the flaw, due to transient cycle loading, were determined to be negative, indicating that the flaw is always loaded in compression. Accordingly, the applicant's crack growth analysis projects zero crack growth for all six cases. The applicant stated that the fatigue crack growth analysis was performed based on an assumed number of transient cycles equal to 1.5 times the number of original design cycles, and therefore the analysis is a TLAA that requires disposition for the period of extended operation. The applicant stated that since the assumed number of cycles for the crack growth analysis bounds the 60-year projected number of cycles from LRA Table 4.3-1, the fatigue crack growth analysis remains valid for the period of extended operation. Accordingly, in LRA Amendment 27, the applicant revised LRA Section 4.7.5.1, to reflect this information, and identified the disposition for the fatigue crack growth analysis as 10 CFR 54.21(c)(1)(i), on the basis that the existing analysis of fatigue crack growth remains valid for the period of extended operation.

The staff reviewed the applicant's supplemental response to RAI 4.7.5.1-1 and found it acceptable for addressing the separate TLAA issue associated with crack growth in the original nozzle weld. The staff finds the applicant's determination that no crack growth would be expected for any number of transient cycles acceptable because the maximum and minimum stress intensity factors for a maximum initial flaw size equal to one-third of the original nozzle weld thickness are negative, due to the compressive loading conditions present for the various flaw orientations analyzed. The staff determined that, since this CLB analysis was performed based on an assumed number of cycles (1.5 times the number of original design cycles) that bounds the number of cycles projected for 60 years, the analysis remains valid for the period of extended operation. Therefore, the staff finds the applicant's selection of a 10 CFR 54.21(c)(1)(i) disposition for the fatigue crack growth analysis is appropriate. Based on the applicant's identification of the ASME Code, Section III, cumulative fatigue usage calculation for demonstrating weld overlay design acceptability, as well as its acceptable disposition of the separate TLAA issue associated with crack growth, as discussed above, the staff concern related to RAI 4.7.5.1-1 is resolved.

Based on its review of this TLAA and supporting documentation, the staff found that the applicant adequately demonstrated that fatigue of the subject weld overlay at Davis-Besse will be appropriately managed under the Fatigue Monitoring Program through the end of the period of extended operation. The staff also finds that management of the subject weld overlay under the Fatigue Monitoring Program will ensure compliance with the requirements of the ASME Code, Section III, 10 CFR 50.55a, and the Davis-Besse TS administrative controls through the end of the period of extended operation. The staff also finds that the applicant adequately demonstrated that the analysis of fatigue crack growth for the original flaw will remain valid for the period of extended operation, because no fatigue crack growth ensures that the original flaw will remain acceptable per the requirements of the ASME Code, Section XI, and ASME Code Case N-504-2.

The staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the structural integrity of the RCS Loop 1 cold leg drain line nozzle weld overlay will be adequately managed for the period of extended operation. The staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that its analysis of the effects of fatigue crack growth on the as-found nozzle weld flaw will remain valid for the period of extended operation because no crack growth is projected through 60 years of facility operation. The staff finds that the applicant's TLAA related to the cumulative fatigue damage of the weld overlay meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also finds that the applicant's TLAA related to the growth of the original flaw meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the CLB analysis of flaw growth remains valid for the period of extended operation.

4.7.5.1.3 USAR Supplement

LRA Section A.2.6.1, as amended, provides the USAR supplement summary description for the TLAA of the RCS Loop 1 cold leg drain line weld overlay repair. The staff reviewed the applicant's USAR supplement summary description for this TLAA and determined that it is consistent with the TLAA discussed LRA Section 4.7.5.1, as amended. The staff also concludes that the information in the USAR supplement is consistent with SRP-LR Sections 4.3.3.3 and 4.7.3.2 for the TLAAs of weld overlay cumulative fatigue and fatigue crack growth, respectively. Based on its review of the USAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the RCS Loop 1 cold leg drain line weld overlay repair for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.5.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue on the RCS Loop 1 cold leg drain line nozzle weld overlay will be adequately managed for the period of extended operation. The staff also concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the existing fatigue crack analysis of the original flaw in the RCS Loop 1 cold leg drain line nozzle weld overlay will remain valid for the period of extended operation. 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).

4.7.5.2 Once-Through Steam Generator 1-2 Flaw Evaluations

4.7.5.2.1 Summary of Technical Information in the Application

LRA Section 4.7.5.2 describes the applicant's TLAA for the OTSG 1-2 flaw evaluations. The applicant stated that many flaw indications were detected in SG 1-2, both in the shell near the steam outlet nozzle and in the shell welds near the lower tubesheet-to-shell juncture during the Cycle 5 RFO (May 1988). According to the applicant, two of the indications in the shell near the steam outlet nozzle were evaluated in accordance with ASME Code, Section XI, IWB-3612 requirements, with the remaining shell indications bounded by those evaluated. The applicant stated that five of the indications in the shell welds near the lower tubesheet-to-shell juncture were evaluated in accordance with ASME Code, Section XI, IWB-3612 requirements, with the remaining shell weld indications bounded by those evaluated.

The applicant stated that an evaluation of fatigue crack growth, based on 240 HU/CD cycles, concluded that there would be only slight crack growth, and the indications were found to be acceptable, in accordance with the ASME Code, Section XI, IWB-3612 analytical acceptance criteria. The applicant also stated that because these analyses are based on a specific number of cycles, they are TLAAs. The applicant further stated that the Fatigue Monitoring Program manages the effects of fatigue on the OTSG flaw evaluations by counting the thermal cycles incurred through the period of extended operation.

Based on the information above, the applicant concluded in the LRA that the effects of fatigue on the OTSG 1-2 flaws will be appropriately managed the during the period of extended operation by the Fatigue Monitoring Program (LRA Section B.2.16), in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.5.2.2 Staff Evaluation

The staff reviewed LRA Section 4.7.5.2 on the OTSG 1-2 flaw evaluation to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the that the effects of fatigue on the OTSG 1-2 flaws will be adequately managed for the period of extended operation.

The staff reviewed the applicant's TLAA consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant shall propose to manage the aging effects associated with the TLAA using an AMP in the same manner described in the IPA in 10 CFR 54.21(a)(3). SRP-LR Section 4.7.3.1.3 also states that the applicable AMP is reviewed to verify that the effects of aging on the intended functions are adequately managed consistent with the CLB for the period of extended operation.

The staff reviewed the information in LRA Section 4.7.5.2 concerning the ASME Code, Section XI evaluations of flaws discovered in the OTSG shell near the steam outlet nozzle and in the shell welds near the lower tubesheet-to-shell juncture. The staff agreed that the ASME Code, Section XI, evaluations of the detected flaws are TLAAs due to the dependence of the flaw crack growth on fatigue and thermal cycles incurred during the period of extended operation.

The staff issued RAI 4.7.5.2-1 on March 17, 2011. RAI 4.7.5.2-1 consisted of Parts a through g. The applicant responded to all parts of RAI 4.7.5.2-1 by letter dated April 15, 2011.

RAI 4.7.5.2-1, Part a, requested that the applicant state the number of flaw indications that were found that did not pass the initial ASME Code, Section XI, IWB-3500 screening criteria. In its response, the applicant stated that a total of 12 indications were found during the Cycle 5 RFO (1988) for OTSG 1-2 that did not meet the ASME Code, Section XI, IWB-3500 flaw screening criteria for disposition of flaws without further evaluation. The applicant noted that the flaws are in ASME Code Class 2 components; however, the ASME Code, Section XI, IWC-3000 acceptance standards for Class 2 components were in the course of preparation at that time. The applicant stated that, of the 12 indications, 10 are associated with the shell welds near the lower tubesheet-to-shell juncture, and two are associated with the shell-to-steam outlet nozzle welds. The applicant stated that the applicable edition of the ASME Code, Section XI, at that time was the 1977 edition with addenda through 1978 of the ASME Code, Section XI. The staff found the applicant's response acceptable because the applicant provided the necessary information concerning the number of flaws discovered that did not pass the IWB-3500 screening criteria.

RAI 4.7.5.2-1, Part b, requested that the applicant state whether the subject flaws were determined to be the result of service-induced degradation or fabrication defects. In its response, the applicant stated that the subject flaws were analyzed in accordance with IWB-3612, as required by the ASME Code, Section XI, acceptance standards, and all flaws were found to be acceptable for continued service. The staff did not find the applicant's response acceptable for addressing its concern as to whether the subject flaws were determined to be the result of service-induced aging or fabrication because the applicant did not address this issue. Accordingly, this issue is addressed in an October 11, 2011 supplemental RAI (RAI 4.7.5.2-2), which is discussed below.

RAI 4.7.5.2-1, Part c, requested that the applicant state whether the OTSG shell materials with flaws have received successive examinations, in accordance with ASME Code, Section XI, requirements, since May 1988. In its response, the applicant stated that initial re-examination of the subject OTSG shell materials was performed for all flawed regions during the Cycle 6 RFO (1990). The applicant stated that the subject materials were again re-examined during the Cycle 7 outage (1991), with the exception of the W axis longitudinal seam weld intersection with the shell-to-lower tubesheet weld. According to the applicant, these re-examinations met the ASME Code, Section XI, IWC-2420(b), requirements for successive inspections of components with flaws that were accepted for continued service in accordance with IWC-3122.3 requirements for acceptance by analytical evaluation.

The staff found the applicant's response to RAI 4.7.5.2-1, Part c, acceptable because the applicant provided the necessary information concerning successive examinations of the OTSG shell materials with flaws, as required by ASME Code, Section XI. The staff found that the applicant successively examined the subject components in accordance with ASME Code, Section XI, IWC-2420(b) requirements, which require the areas containing flaws or relevant conditions in components accepted for continued service, in accordance with IWC-3122.3 or IWC-3132.3, to be re-examined during the next inspection period listed in the schedule of the Inspection Program of IWC-2400. If the reexaminations reveal that the flaws or relevant conditions are essentially unchanged, IWC-2420(c) allows the component examination schedule to revert to the original schedule of subsequent inspections.

RAI 4.7.5.2-1, Part d, requested that the applicant state when the next inservice examination is scheduled for the OTSG components with flaws. In its response, the applicant stated that the only OTSG flaw location still scheduled for examination during the current (third) 10-year ISI interval is the OTSG 1-2 W/X axis outlet nozzle-to-shell weld, which was scheduled for examination (and in fact was examined) during the Cycle 17 mid-cycle outage (2011). The applicant stated that the OTSG 1-2 X/Y axis outlet nozzle-to-shell weld and lower tubesheet-to-shell weld were examined in the second and first periods of the third 10-year ISI interval, respectively. The staff found the applicant's response acceptable because the applicant provided the necessary information concerning the scheduled examination of the remaining flawed region for the third 10-year ISI interval, as well as information concerning the examinations of the flawed regions already completed for the third 10-year ISI interval. The staff finds that this information demonstrates that the flawed regions are being examined in accordance with requirements of the ASME Code, Section XI, IWC-2000, for the third 10-year ISI interval.

RAI 4.7.5.2-1, Part e, requested that the applicant state whether the dimensions of any of the flaws have increased since discovery in 1988. In its response, the applicant stated that no flaw growth was noted during either the Cycle 6 outage (1990) inspections, where all flawed regions were re-examined, or during the Cycle 7 outage (1991) inspections, where all flawed welds were re-examined except for the W/X axis longitudinal seam weld intersection with the shell-to-lower tubesheet weld. The staff reviewed the applicant's response and noted that the RAI response only stated that no flaw growth was noted during the ASME Code, Section IWC-2420(b)-required successive inspections performed in 1990 and the subsequent inspections performed in 1991. The applicant did not state whether any flaw growth was noted for the subject components from any examinations performed on the flawed regions after 1991. The staff identified the need for supplemental information regarding this response, as described below for RAI 4.7.5.2-2.

RAI 4.7.5.2-1, Part f, requested that the applicant state whether the existing flaw growth analyses for the subject flaws are bounding relative to the projected number of thermal cycles for the period of extended operation. In its response, the applicant stated that the projected flaw growth calculations are based on the design basis assumption of 240 HU/CD cycles, as stated in LRA Section 4.7.5.2. The applicant referred to LRA Table 4.3-1, where the 60-year projection of HU/CD cycles is 128, which is bounded by the assumed 240 cycles used in the subject flaw evaluations. The staff found the applicant's response to be acceptable because the existing flaw growth analyses are based on an assumed 240 thermal cycles, which bounds the number of thermal cycles (128 cycles) that is projected for the period of extended operation.

RAI 4.7.5.2-1, Part g, requested that the applicant provide references for all reports previously submitted to the NRC, which document ASME Code, Section XI, analytical evaluations of the subject flaws. In its response to RAI 4.7.5.2-1, the applicant provided the following references for the subject flaw evaluations:

- B&W Report 32-1172294-00, "Davis-Besse 1 SG Flaw Evaluation," June 9, 1988
- B&W Report 32-1172294-01, "Davis-Besse 1 SG Flaw Evaluation," July 18, 1988
- B&W Report 32-1172523-00, "DB-1 SG Flaw Evaluation," July 18, 1988

The applicant provided a copy of each report in Enclosure D to its RAI response. Therefore, the staff reviewed these reports to determine whether they support operation of the OTSG during the period of extended operation.

The staff determined that the 1988 flaw evaluation reports state that the subject flaws were found to be acceptable, in accordance with the 1977 edition of the ASME Code, Section XI, IWB-3612 analytical acceptance standard. Based on its review, the staff determined that these flaw evaluation reports demonstrate that all of the subject OTSG shell flaws will meet the analytical acceptance criterion specified in the ASME Code, Section XI, IWB-3612, paragraph A for normal (including upset and test) operating conditions during the period of extended operation. Specifically, the flaw evaluation reports demonstrate that, for all of the flaws, the ratio of shell material fracture toughness to the maximum applied stress intensity factor for the limiting normal/upset condition transient is projected to be significantly greater than the square root of ten, as required by the ASME Code, Section XI, IWB-3612, paragraph A. The staff also confirmed that the applied stress intensity factors were calculated using the procedures in the ASME Code, Section XI, Appendix A, and consider projected flaw growth due to fatigue as a result of 240 HU/CD cycles (design cycles), which bounds the number of projected cycles for the period of extended operation (128 HU/CD cycles).

In reviewing the above flaw evaluation reports, the staff determined that the subject flaw evaluations were only performed for normal (including upset and test) operating conditions, as specified in the ASME Code, Section XI, IWB-3612, paragraph A. The staff determined that it needed clarification on the applicant's evaluation of the subject flaws for emergency and faulted conditions, as required by the 1977 edition of the ASME Code, Section XI, IWB-3612, paragraph B. This request is described below for RAI 4.7.5.2-2.

LRA Section 4.7.5.2 states that the effects of fatigue on the OTSG 1-2 flaws will be managed during the period of extended operation under the Fatigue Monitoring Program (LRA Section B.2.16), in accordance with 10 CFR 54.21(c)(1)(iii). The staff reviewed the applicant's Fatigue Monitoring Program (SER Section 3.0.3.2.6) and determined that this program is not acceptable for managing the effects of aging on OTSG 1-2 flaw growth. This determination was made because the applicant's Fatigue Monitoring Program is structured to count transient cycles to ensure that the plant's design-basis transient cycles are not exceeded, thereby ensuring that the ASME Code, Section III cumulative fatigue usage limits are not exceeded. The CUF analyses are evaluated as separate TLAAs in LRA Section 4.3. The LRA Section 4.3 CUF analyses do not address the growth of preexisting flaws. The applicant's Fatigue Monitoring Program is not structured to count transient cycles against ASME Code, Section XI, IWB-3612 analyses, which address the growth of preexisting flaws.

Based on the above concern, by letter dated April 20, 2011, the staff issued RAI B.2.16-7, requesting that the applicant justify the use of cycle counting, as described in the Fatigue Monitoring Program, for the analysis described in LRA Section 4.7.5.2, without an update to applicable TS requirements and cycle counting procedures, and without enhancements to the applicable Fatigue Monitoring Program Elements.

By letter dated June 3, 2011, the applicant provided a response to RAI B.2.16-7, indicating that the 10 CFR 54.21(c)(1)(iii) disposition and Fatigue Monitoring Program are no longer used for the LRA Section 4.7.5.2 TLAA of the OTSG 1-2 flaws. In an Enclosure to the RAI response, the applicant provided LRA Amendment 8. LRA Amendment 8 revised the disposition for the analysis of the OTSG 1-2 flaws in LRA Section 4.7.5.2 from "10 CFR 54.21(c)(1)(iii)" to "10 CFR 54.21(c)(1)(i)." LRA Amendment 8 added the following to LRA Section 4.7.5.2:

> Simplified evaluation of fatigue crack growth, based on 240 [HU/CD] cycles, concluded that there would be only slight crack growth, and the indications were found to be acceptable by ASME [Code] Section XI, IWB-3612 standards. Because these analyses are based on a specific number of cycles, they are TLAAs. As shown in LRA Table 4.3-1, the 60-year projected cycles for [HU/CD] are 128 and are bounded by the analyzed number of 240. Therefore, the [SG] flaw growth analyses will remain valid through the period of extended operation.

The staff reviewed the applicant's justification for revising the disposition of the OTSG 1-2 flaw TLAA from 10 CFR 54.21(c)(1)(iii) to 10 CFR 54.21(c)(1)(i) and determined that it is appropriate because the existing flaw growth analyses are based on an assumed 240 thermal cycles, which bounds the number of thermal cycles (128 cycles) that is projected for the period of extended operation.

To address the concerns above regarding the applicant's response to RAI 4.7.5.2-1, Parts b, e, and g, by letter dated October 11, 2011, the staff issued RAI 4.7.5.2-2 requesting the following:

1) Taking into consideration the OTSG shell materials containing the flaws, the secondary side water and steam environment, and the secondary side thermal and pressure stresses to which these shell components are subjected, the staff requested that the applicant state whether any of the surface-breaking indications were believed to have been caused by stress corrosion cracking, or any other service-induced aging effect.

2) For any inservice examinations performed on the flawed regions of the OTSG shell after 1991, in particular the examinations performed for the OTSG X/Y axis outlet nozzle to shell weld and the lower tubesheet to shell weld during the first and second periods of the third 10-year ISI interval, the staff requested that the applicant state whether these examinations detected any increase in the flaw dimensions, relative to the 1988 flaw dimensions. (The staff notes that any measured increase in flaw dimensions could possibly invalidate the analyses performed in the 1988 flaw evaluation reports.)

3) The staff requested that the applicant state whether the subject flaws were analyzed for emergency and faulted conditions, as required by the ASME Code, Section XI, IWB-3612, paragraph B. If the subject flaws were analyzed for emergency and faulted conditions, as required by IWB-3612, paragraph B, the staff requested that the applicant provide the flaw analyses for these conditions, or explain how the IWB-3612, paragraph A analyses, as documented in the 1988 flaw evaluation reports, for normal, upset, and test conditions, would bound the flaw analyses for emergency and faulted conditions. If the subject flaws were not analyzed for emergency and faulted conditions, the staff requested that the applicant provide these analyses, as required by IWB-3612, paragraph B.

By letter dated November 23, 2011, the applicant provided its response to RAI 4.7.5.2-2, which addressed the three issues identified above.

The applicant's response to RAI 4.7.5.2-2, Part 1, stated that the OTSG shell material containing the flaws is carbon steel with an environment of treated water (liquid and steam phases). The applicant stated that the aging management review (AMR) of the OTSG components did not identify stress corrosion cracking as an aging management concern for the SG shell. The applicant also stated that stress corrosion cracking is an applicable aging effect for carbon steel exposed to treated water only if there is a potential for microbiologically-influenced corrosion (MIC) contamination, pH less than 10.5, temperature less than 210 °F, and use of nitrite corrosion inhibitor. The applicant referenced EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guidance and Mechanical Tools," Revision 4, as the basis for its determination. Based on a review of plant-specific operating experience, the applicant identified instances of MIC only for open cycle cooling water systems. The applicant stated that MIC is not an age-related concern for the OTSG shell operating in a treated water environment at Davis-Besse. The applicant therefore concluded that the OTSG flaws were not caused by stress corrosion cracking.

The applicant also addressed whether the subject flaws could have been caused by fatigue. The applicant stated that the AMR addressed cracking due to fatigue as an aging effect requiring further evaluation and noted that carbon steel above 220 °F is susceptible to cracking due to fatigue. The applicant noted that the ASME Code, Section III, requires calculation of cumulative usage factors (CUFs) and states that CUFs shall be less than 1.0. The applicant stated that the OTSGs were analyzed for fatigue, and the CUFs for the limiting primary and secondary side OTSG locations, which were calculated based on design transients, are less than 1.0, based on the projected design cycles. The applicant pointed to LRA Table 4.3-1, "60-Year Projected Cycles," and noted that the accrued cycles as of February 19, 2008 were less than the design cycles. The applicant therefore concluded that the OTSG flaws were not caused by cracking due to fatigue.

The applicant stated that the AMR also identified cracking due to the growth of preexisting flaws as an aging effect requiring management for the carbon steel components of the OTSGs that are exposed to the treated water environment. The applicant stated that components fabricated in accordance with the ASME Code are presumed to contain material and fabrication flaws whose sizes and character are below the detection threshold of the examination method employed, or less than the acceptance standards. According to the applicant, the presence of such flaws led to the recognition that these flaws might grow in size as a consequence of the loadings imposed on the component during the service lifetime.

The applicant stated that, based on its determination that the subject flaws were not caused by stress corrosion cracking or fatigue, it is believed that the subject flaws are pre-service flaws that were below the detection threshold of the examination method employed during fabrication of OTSG 1-2.

The staff found the applicant's response to RAI 4.7.5.2-2, Part 1, acceptable because the applicant provided sufficient evidence for the staff to determine that the subject flaws were likely not caused by service-induced aging, although potential accelerating effects of reactor water environment on fatigue cracking cannot be ruled out. Specifically, based on its review of the applicant's response to RAI 4.7.5.2-2, Part 1, the staff found that the applicant's AMR results (LRA Table 3.1.2-4) for the OTSGs correctly identified that stress corrosion cracking is not an aging management concern for the carbon steel shell material because this aging mechanism would not be expected to occur for the carbon steel shell in a secondary side treated water environment, where MIC is not possible. The staff confirmed that the GALL Report, Revision 2, AMR results also do not identify stress corrosion cracking as an aging management concern for the OTSG shell material. With respect to cracking due to fatigue, the staff noted that LRA Table 3.1.2-4 AMR for the SGs did identify cracking due to fatigue as an aging effect applicable to the shell. However, consistent with the applicant's response to RAI 4.7.5.2-2, Part 1, the staff confirmed that the CUFs for the limiting primary and secondary side OTSG locations are less than 1.0 (LRA Section 4.3.2.2.6.1), based on the design transients and projected design cycles. The staff noted that the total accumulated cycles as of February 19, 2008, are far less than the design cycles. Since the flaws were discovered in 1988, the staff determined that they are unlikely to have been caused by fatigue because the cycles incurred through that time were less than the cycles incurred through February 19, 2008, and therefore, were well bounded by the design cycles. The staff determined that no other known aging effects could have caused the subject flaws. Therefore, based on the above, the staff determined that the applicant provided sufficient information to conclude that service-induced aging likely did not cause the subject flaws.

The applicant's response to RAI 4.7.5.2-2, Part 2, addressed whether recent examinations detected any increase in the flaw dimensions. This response stated that examinations of the flawed OTSG shell regions were performed during the third 10-year ISI interval, and none of these examinations detected any flaw growth relative to the 1988 flaw dimensions. This includes the most recent examination of the OTSG 1-2 W/X axis outlet nozzle to shell weld, which was completed during the October 2011 midcycle outage. The staff found the applicant's response acceptable for resolving its concern because the applicant provided information confirming that the flaws have exhibited no measurable increase in size since initial detection.

The applicant's response to RAI 4.7.5.2-2, Part 3, stated that the subject OTSG shell flaws were not previously analyzed for emergency and faulted conditions, as required by the ASME Code, Section XI, IWB-3612, paragraph B. Accordingly, the applicant stated that the subject flaw evaluation reports have been revised to address the analysis of the subject flaws under emergency/faulted conditions, as required by the ASME Code, Section XI, IWB-3612, paragraph B. The applicant concluded that the flawed OTSG shell materials would remain acceptable for continued service during the period of extended operation, in accordance with the ASME Code, Section XI, IWB-3612, paragraph B.

Enclosures C and D of the applicant's response to RAI 4.7.5.2-2 included the revised flaw evaluation reports, which document the analytical evaluations of the subject flaws for both normal/upset and emergency/faulted conditions. The staff reviewed the revised flaw evaluation reports provided in Enclosures C and D. Based on its review, the staff determined that the revised flaw evaluation reports demonstrate that all of the subject flaws will meet the analytical acceptance criterion specified in the ASME Code, Section XI, IWB-3612, paragraph B for emergency/faulted conditions during the period of extended operation. Specifically, the revised flaw evaluation reports demonstrate that, for all of the subject flaws, the ratio of OTSG shell material fracture toughness to the maximum applied stress intensity factor due to applied loads during the limiting emergency transient is projected to be significantly greater than the square root of two, as required by the ASME Code, Section XI, IWB-3612, paragraph B. The staff also noted that the original flaw evaluations for normal/upset conditions were not changed in the revisions provided in Enclosures C and D. Therefore, the staff determined that the applicant's response to RAI 4.7.5.2-2, Part 3, is acceptable because the applicant demonstrated that all of the subject flaws will remain in compliance with analytical acceptance criteria specified in the ASME Code, Section XI, IWB-3612, paragraphs A and B for the period of extended operation.

Based on its evaluation, the staff determined that the applicant's responses to all parts of RAIs 4.7.5.2-1 and 4.7.5.2-2 are acceptable as described above, and the staff's concerns described in these RAIs are resolved.

The staff finds that the applicant demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of the OTSG 1-2 shell flaws remain valid for the period of extended operation. Additionally, the staff finds that the applicant's TLAA meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the analyses of the OTSG 1-2 shell flaws remain valid for the period of extended operation

4.7.5.2.3 USAR Supplement

As revised in LRA Amendment 8 by letter dated June 3, 2011, LRA Section A.2.6.2 provides the USAR supplement summary description for the TLAA of the OTSG 1-2 flaw evaluations. LRA Amendment 8 revised the disposition for the analysis of the OTSG 1-2 flaws in LRA Section A.2.6.2 from 10 CFR 54.21(c)(1)(iii) to 10 CFR 54.21(c)(1)(i), consistent with the revised disposition identified in LRA Amendment 8, Section 4.7.5.2. The staff reviewed the applicant's amended USAR supplement summary description for this TLAA and determined that it is consistent with the TLAA discussed in LRA Section 4.7.5.2, as amended. The staff also concludes that the information in the USAR supplement is consistent with SRP-LR Section 4.7.3.2. Based on its review of the USAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the OTSG 1-2 flaw evaluations for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.5.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the existing analyses for the OTSG 1-2 flaws remain valid for the period of extended operation. 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).

4.7.6 ASME Code Case N-481 Evaluation

4.7.6.1 Summary of Technical Information in the Application

By letter dated August 17, 2011, in response to RAI 4.1-2, the applicant provided LRA Amendment 13 to, in part, include LRA Section 4.7.6, which describes the TLAA related to the fatigue analysis associated with ASME Code Case N-481 of the RCP casings.

The applicant stated that it has invoked the use of ASME Code Case N-481 for its stainless steel RCP casings. The applicant stated that the staff has accepted Code Case N-481 for use in ISI inspection programs. The applicant also stated that this code case allows the replacement of volumetric examinations of primary loop pump casings with a fracture mechanics-based evaluation supplemented by specific visual examinations, and includes a fatigue crack growth analysis. The applicant further stated that the code case evaluation includes two areas that potentially involve time-dependency assumptions, the fracture toughness property assumed in the analysis for the RCP CASS material of fabrication and the fatigue flaw growth analysis for the casings. The applicant stated that the fracture toughness parameter is not time-dependent because the analysis used a lower-bound fracture toughness value of 139 ksi-in$^{1/2}$ that bounds the saturated fracture toughness of the CASS material.

The applicant further stated that the fatigue crack growth analysis, which is based on design cycles for a 40-year plant life, is a TLAA requiring disposition for license renewal. The applicant stated that the fatigue flaw growth analysis conservatively assumed 2,000 transient cycles, and the growth of postulated flaw remained below the critical crack size. The applicant stated that, since the 2,000 cycles assumed in the analysis bounds the number of 60-year projected cycles assumed for the transients in LRA Table 4.3-1, the ASME Code Case N-481 analysis of the RCP casings is acceptable, in accordance with 10 CFR 54.21(c)(1)(i), and remains valid for the period of extended operation.

4.7.6.2 Staff Evaluation

The staff reviewed new LRA Section 4.7.6 provided in LRA Amendment 13, on the fatigue analysis associated with the ASME Code Case N-481 evaluation of the RCP casings, to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis remains valid for the period of extended operation. The staff reviewed the applicant’s TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.7.3.1.1, which state that the reviewer should verify that the existing analysis remains valid for the period of extended operation.

During its review of the LRA, the staff noted that LRA Section 4.3.2.2.4 describes the fatigue TLAA for the RCP casings and states that the casings were analyzed for fatigue by the OEM to meet the requirements of the ASME Code, Section III, 1968 edition through winter 1968 addenda. LRA Table 3.1.1, item 3.1.1-55, states that the aging of these pump casings will be managed by its ISI Program and invokes the use of ASME Code Case N-481. The staff noted that its endorsement of ASME Code Case N-481, as referenced in RG 1.147, Revision 14, and permitted in 10 CFR 50.55a(b), requires the performance of a crack-growth evaluation on the RCP casing in order to support justification of the alternative visual inspection requirements for the pump casing. The staff also noted that the LRA did not identify a TLAA disposition of ASME Code Case N-481. As described in SER Section 4.3.2.2, the staff issued RAI 4.1-2 by letter dated May 2, 2011, requesting the applicant to justify the absence of TLAA identification in the LRA for the RCP casing regarding the application of Code Case N-481.

The applicant's response dated June 17, 2011, described the analysis to justify use of ASME Code Case N-481. The applicant revised its response to RAI 4.1-2 by letter dated August 17, 2011, and provided LRA Amendment No. 13, which included new LRA Section 4.7.6.

The applicant's revised RAI response identified that Topical Report No. SIR-99-040, Revision 1, "ASME Code N-481 Evaluation of Davis Besse Reactor Coolant Pumps" (ADAMS Accession No. ML011200090), was used to support the alternative visual examination basis. FENOC submitted this analysis to the NRC by letter dated April 23, 2001. The applicant's revised response to RAI 4.1-2 identified two potential time-dependencies in SIR-99-040 Revision 1: (1) the fracture toughness property of the CASS material that was used to fabricate the RCP casing, and (2) the time-dependency on the fatigue flaw growth analysis that was performed.

For the fracture toughness property, the applicant's response stated that the fracture toughness of the CASS material is not time-dependent because the analysis assumed a lower-bound fracture toughness that bounded the fracture toughness of the CASS material under assumed saturated thermal aged conditions. The staff noted that the applicant's basis may be predicated on thermal aging data that are not up to date or conservative when compared to the most recent data for the industry.

By letter dated October 21, 2011, the applicant supplemented its response to RAI 4.1-2 and LRA Section 4.7.6 by comparing the thermal aging data used in the SIR-99-040 to the most-recent industry data in two NUREG reports. The applicant stated that the saturation fracture toughness value in SIR-99-040, Revision 1, was determined using the methodology outlined in NUREG/CP-0119, Volume 2, pages 151–178, "Proceedings of the USNRC, 19th Water Reactor Safety Information Meeting held at Bethesda, MD, October 28-30, 1991," considering all available certified material test report for the base material and welds of the Davis-Besse reactor coolant pump casings. The applicant also stated that the minimum saturation fracture toughness value has since been re-calculated using NUREG/CR-4513, Revision 1, "Estimation of Fracture Toughness of Cast Stainless Steels During Thermal Aging in LWR Systems," which is based on the most recent published data on this subject matter. The applicant confirmed that using the methodology and correlation in this latest NUREG resulted in the same minimum saturation fracture toughness value for the pump casings as that used in SIR-99-040, Revision 1.

The applicant stated that the fracture toughness for thermal aging of welds has also been presented in NUREG/CR-6428, "Effects of Thermal Aging on Fracture Toughness and Charpy-Impact Strength of Stainless Steel Pipe Welds." Using a conservative J_{Ic} fracture toughness value of 40 kJ/m^2 based in this NUREG/CR report, the applicant determined that the corresponding K_{Ic} value is 80 ksi-$in^{1/2}$. The applicant concluded that the applied stress intensity factors, calculated in Table 4-5 of SIR-99-040, Revision 1, are bounded by the K_{Ic} value of 80 ksi-$in^{1/2}$, and thus the conclusion in SIR-99-040, Revision 1, remains valid. The staff reviewed NUREG/CR-6428 and confirmed that the J_{Ic} value of 40 kJ/m^2 represents an acceptable lower bound fracture toughness value based on the data in the NUREG report. The staff also confirmed that the stress intensity factors listed in SIR-99-040, Revision 1, for normal and upset conditions do not exceed the values of 80 ksi-$in^{1/2}$. Thus, the staff concluded that the applicant's calculation remain valid when comparing to the most-recent available data in the NUREG/CR-6428 and that there is not any time-dependency for the lower bound fracture toughness value that was assumed for the pump casing material. Thus the potential TLAA related to the fracture toughness property aspect of the ASME Code Case N-481 evaluation is not a TLAA in accordance with 10 CFR 54.3, because it does not involve time-limited assumptions defined by the current operating term.

Regarding the potential time dependency of the fatigue flaw growth analysis discussed in SIR-99-040 (Revision 1), the staff noted that the significant transients considered in the fatigue crack growth analysis are HU/CD, loss of secondary pressure, hydrotest, and leak test because these transients are associated with very high pressure and temperature changes. The staff confirmed that the fatigue flaw growth analysis in SIR-99-040, Revision 1, was analyzed to 2,000 cycles for a 40-year plant life. The staff also confirmed that LRA Table 4.3-1 indicates that the total number of cycles projected for these transients through 60 years of operations would be less than the value of 2,000 that was assumed in the fatigue crack growth analysis in the ASME Code Case N-481 evaluation. The staff's evaluation of the applicant's projection methodology for design transients is documented in SER Section 4.3.1.2.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue flaw growth analysis associated with ASME Code Case N-481 for RCP casings is acceptable because the existing analysis in the CLB will remain valid for the period of extended operation. Additionally, the staff finds that the analysis meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the 60-year projected number of cycles is less than the number assumed in the fatigue flaw growth analysis.

4.7.6.3 USAR Supplement

LRA Section A.2.7.5, as amended by letters dated August 17 and October 21, 2011, provides the USAR supplement summarizing the analysis of RCP casing associated with ASME Code Case N-481. The staff reviewed LRA Section A.2.7.5 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the USAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the amended USAR supplement, the staff finds the supplement meets the acceptance criteria in SRP-LR Section 4.7.2.2. Additionally, the staff determined that the applicant provided an adequate summary description associated with the TLAA for ASME Code Case N-481 of the RCP casings regarding the basis for determining that the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

4.7.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue flaw growth analysis for the ASME Code Case N-481 evaluation of the RCP casings remains valid for the period of extended operation. 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).

4.7.7 Crane Load Cycles

4.7.7.1 Summary of Technical Information in the Application

By letter dated October 7, 2011, the applicant provided LRA Amendment No. 19 to include new LRA Sections 4.7.7 and A.2.7.6, both titled “Crane Load Cycles,” to address the disposition of the TLAA associated with crane load cycles. This amendment was initiated in response to FENOC-generated OI Number OIN-378, which resulted from the NRC Region III implementation of Inspection Procedure IP-71002, “License Renewal Inspection,” during the week of August 22, 2011, to address an inspector request regarding crane cycles.

LRA Section 4.7.7 describes the applicant’s TLAA for crane load cycles. The applicant stated that the load cycle limits for cranes were identified as a potential TLAA, and the following cranes are in the scope of license renewal and have been identified as having a TLAA, which requires evaluation for 60 years:

- containment polar crane (including auxiliary hoist)
- reactor service crane
- spent fuel shipping cask crane (including auxiliary hoist)
- intake structure gantry crane

The applicant also stated that these cranes are designed in accordance with Bechtel design specifications, which require that the cranes be designed in accordance with the minimum requirements for Class A cranes as stated in Crane Manufacturers Association of America (CMAA) Specification 70 for Electric Overhead Traveling Cranes.

The applicant dispositioned the TLAA for crane load cycles in accordance with 10 CFR 54.21(c)(1)(i), that these analyses remain valid during the period of extended operation.

4.7.7.2 Staff Evaluation

During the NRC staff’s inspection per Inspection Procedure IP-71002, “License Renewal Inspection,” during the week of August 22, 2011, the staff raised a concern regarding the absence of discussion of fatigue TLAAs for steel cranes in LRA Section 4, as documented in Section 3.11 of Inspection Report 05000346/2011012, dated October 7, 2011. By letter dated October 7, 2011, the applicant revised the LRA to include new Sections 4.7.7 and A.2.7.6, both titled “Crane Load Cycles,” to address the disposition of the TLAA associated with crane load cycles.

The staff reviewed LRA Section 4.7.7 on crane load cycles to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remains valid during the period of extended operation. This review was performed consistent with the review procedures in SRP-LR Section 4.7.3.1.1, which state that the existing analyses should be shown to be bounding even during the period of extended operation.

For the containment polar crane (including auxiliary hoist), the applicant stated that the rate of occurrence using this crane is based on refueling RFOs, mid-cycle outages with core off load, and the final core off load at the end of 60 years of operation, and a total of 22,000 cycles is expected through the period of extended operation. The staff noted that an additional 500 cycles was estimated for the pre-operational construction period, which is included in the estimate of 22,000 cycles.

For the reactor service crane, the applicant stated that the rate of occurrence is based on RFOs, mid-cycle outages with core off load, and the final core off load at the end of 60 years of operation, and a total of 8,000 cycles is expected through the period of extended operation. The staff noted that an additional 500 cycles was estimated for the pre-operational construction period, which is included in the estimate of 8,000 cycles.

For the spent fuel shipping cask crane (including auxiliary hoist), the applicant stated that the rate of occurrence is based on RFOs, mid-cycle outages with core off load, and the final core off load at the end of 60 years of operation, and a total of 18,000 cycles is expected through the period of extended operation. The staff noted that an additional 500 cycles and 3,600 cycles were estimated for crane usage during the pre-operational construction period and during non-outage periods, respectively, which are included in the estimate of 18,000 cycles.

For the intake structure gantry crane, the applicant stated the rate of occurrence is based on crane usage throughout the calendar year at 20 cycles per year and a total of 1,700 cycles is expected through the period of extended operation. The staff noted that an additional 500 cycles are estimated for the pre-operational construction period, which are included in the estimate of 1,700 cycles.

The staff reviewed CMAA No. 70 and confirmed that Service Class A cranes are designed for up to 100,000 load cycles. The staff finds that the applicant conservatively accounted for crane usage during the pre-operational construction period and during non-outage periods for the spent fuel shipping cask crane (including auxiliary hoist). The staff noted that the applicant's estimated use levels of these Service Class A cranes are based on operations that are routine and predictable, which occur during RFOs, mid-cycle outages, core off loads, and normal operation; therefore, the staff finds the applicant's estimates for its crane usage to be reasonable. For the containment polar crane (including auxiliary hoist), reactor service crane, spent fuel shipping cask crane (including auxiliary hoist) and intake structure gantry crane, the staff noted that the applicant's estimates for crane usage through the period of extended operation were no more than 22 percent of the 100,000 design load cycles specified in CMAA No.70. Additionally, the staff finds that there is a sufficient margin to account for unexpected crane use through the period of extended operation.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of load cycles for those cranes discussed above remain valid for the period of extended operation. Additionally, the analyses meet the acceptance criteria in SRP-LR Section 4.7.2.1 because the estimated usage of the cranes described above is significantly less than the 100,000 design load cycles specified in CMAA No. 70 for Service Class A cranes, and these analyses bound the crane usage through the period of extended operation.

4.7.7.3 USAR Supplement

LRA Section A.2.7.6 provides the USAR supplement summarizing the TLAA for crane load cycles of the containment polar crane (including auxiliary hoist), reactor service crane, spent fuel shipping cask crane (including auxiliary hoist), and intake structure gantry crane. The staff reviewed LRA Section A.2.7.6 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the USAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the USAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for crane load cycles, as required by 10 CFR 54.21(d).

4.7.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the crane load cycles of the containment polar crane (including auxiliary hoist), reactor service crane, spent fuel shipping cask crane (including auxiliary hoist), and intake structure gantry crane remain valid for the period of extended operation. 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).

4.8 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 provided a sufficient list of TLAAs, as defined in 10 CFR 54.3, and that the applicant has demonstrated the following:

- The TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i).
- The TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii).
- The effects of aging on intended functions will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii).

The staff also reviewed the USAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2), that no plant-specific, TLAA-based exemptions are in effect.

With regard to these matters, the staff concludes that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB. Additionally, any changes made to the CLB, in order to comply with 10 CFR 54.29(a), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10, Part 54, of the *Code of Federal Regulations*, the Advisory Committee on Reactor Safeguards (ACRS) will review the license renewal application (LRA) for Davis-Besse Nuclear power Station (Davis-Besse). The ACRS Subcommittee on Plant License Renewal will continue its detailed review of the LRA after this safety evaluation report (SER) is issued. FirstEnergy Nuclear Operating Company (FENOC or the applicant) and the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) will meet with the Subcommittee and the Full Committee to discuss issues associated with the review of the LRA.

After the ACRS completes its review of the LRA and SER, the Full Committee will issue a report discussing the results of the review. An update to this SER will include the ACRS report and the staff's response to any issues and concerns reported.

SECTION 6

CONCLUSION

The staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) reviewed the license renewal application (LRA) for Davis-Besse Nuclear Power Station (Davis-Besse) in accordance with NRC regulations and NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP-LR), dated December 2010. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) sets the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff determines that the requirements of 10 CFR 54.29(a) have been met.

The staff noted that any requirements of 10 CFR Part 51, Subpart A, will be documented in a draft supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Davis-Besse Nuclear Power Station," to be issued at a later date.

APPENDIX A

Davis-Besse Nuclear Power Station License Renewal Commitments

During the review of the Davis-Besse Nuclear Power Station (Davis-Besse) license renewal application (LRA) by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff), FirstEnergy Nuclear Operation Company (FENOC or the applicant) made commitments related to aging management programs (AMPs) to manage the aging effects of structures and components (SCs) prior to the period of extended operation. The following table lists these commitments, as well as the implementation schedules and the sources for each commitment.

Table A-1. Davis-Besse License Renewal Commitments

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
1	Enhance the Aboveground Steel Tanks Inspection Program to do the following: • Include a volumetric examination of tank bottoms to detect evidence of loss of material due to crevice, general, or pitting corrosion, or to confirm a lack thereof. • Establish the examination technique, the inspection locations, and the acceptance criteria for the examination of the tank bottoms. • Require that unacceptable inspection results be entered into the FENOC Corrective Action Program. • Ensure that the volumetric examination of the tank bottoms will be performed within 5 years after entering the period of extended operation and that additional opportunistic tank bottom inspections will be performed whenever the tanks are drained.	A.1.2 B.2.2 Response to NRC RAI B.2.2-1 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153 and L-13-160
2	Implement the Boral® Monitoring Program as described in LRA Section B.2.5.	A.1.5 B.2.5 and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
3	Enhance the Buried Piping and Tanks Inspection Program to do the following: • Add bolting for buried Fire Protection System piping and the emergency diesel fuel oil storage tanks (DB-T153-1, DB-T153-2) to the scope of the program. • Conduct annual ground potential surveys of the cathodic protection system using the acceptance criteria listed in NACE RP0285 2002 and NACE SP0169-2007. • Monitor cathodic protection voltage and current monthly to determine the effectiveness of cathodic protection systems and, thereby, the effectiveness of corrosion mitigation. • Trend voltage, current, and ground potential readings and evaluate for adverse changes.	A.1.7 B.2.7 and Response to NRC RAI B.2.7-1 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153 and L-13-160

<table>
<tr><th>Item Number</th><th>Commitment</th><th>Updated Safety Analysis Report (USAR) Supplement Section No// Comments</th><th>Implementation Schedule</th><th>Source</th></tr>
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Require that the activity of the jockey fire pump or equivalent parameter be monitored on at least a monthly interval.
Conduct a flow test by the end of the next refueling outage when unexplained changes in jockey pump activity are observed.
Require that the directed buried pipe inspection locations be selected based on risk.
Require that the minimum number of buried in-scope piping inspections during the 30–40, 40–50, and 50–60 year operating period is one steel safety-related piping segment and one steel piping segment containing hazardous material.
Perform the directed buried steel pipe and tank inspections each 10-year interval based upon the following table. Each inspection will have a minimum of 10 feet of piping inspected.

<table>
<tr><th>Preventive Actions</th><th># of inspections of safety related piping or tanks</th><th># of Hazmat inspections or % of pipe length</th></tr>
<tr><td>A</td><td>1 (Note 2)</td><td>1 (Note 2)</td></tr>
<tr><td>B</td><td>1</td><td>2%</td></tr>
<tr><td>C</td><td>4</td><td>5%</td></tr>
<tr><td>D</td><td>8</td><td>10%</td></tr>
</table>
Note 1: Preventive actions are categorized as follows:
A. Cathodic protection, in accordance with NACE SP0169-2007 or NACE RP0285-2002, was installed for at least 5 years prior to entering the period of extended operation and was operational for 90% of the time during that 5 years or cathodic protection was operational for 90% of the time since the last inspection conducted under this program.
B. Cathodic protection, in accordance with NACE SP0169-2007 or NACE RP0285-2002, was installed for less than 5 years prior to entering the period of extended operation or was operational for less than 90% of the time during that 5 years or cathodic inspection was operational for less than 90% of the time since the last inspection conducted under this program
C. Protective coatings are in place and no mechanical coating damage due to the backfill, but cathodic protection is not provided or not in accordance with criteria A or B and the period of extended operation has not been entered.
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</table>

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	D. Criteria of A, B, and C are not met. Note 2: Only one inspection is required for piping which is both safety-related and contains hazardous material. • Require that the EDG Fuel Oil Storage Tanks (DB-T153-1 and DB-T153-2) be inspected prior to entering the period of extended operation. The inspection will be either a visual inspection of at least 25% of each tank and include at least some portion of the tank top and bottom or, an internal inspection consisting of UT measurements with at least one measurement per square foot of the surface of the tanks. These inspections are not required if it is demonstrated that the tanks are cathodically protected in accordance with NACE SP0169-2007 or NACE RP0285-2002. • Require that a visual and volumetric inspection of the underground piping within the borated water piping trench will be performed during each 10-year period beginning no sooner than 10 years prior to the entry into the period of extended operation. • Require that if adverse indications are detected, additional buried in-scope piping inspections be performed in order to provide reasonable assurance of the integrity of buried piping. • Base the selection of components to be examined on previous examination results, trending, risk ranking, and areas of cathodic protection failures or gaps, if applicable. • Continue additional sampling until reasonable assurance of the integrity of buried piping is provided. • Require that an inspection of buried Fire Protection System bolting will be performed when the bolting becomes accessible during opportunistic or focused inspections. • Require that the inspections of buried piping be conducted using visual (VT-3 or equivalent) inspection methods. Excavation shall be a minimum of 10 linear feet of piping, with all surfaces of the pipe exposed.			
4	Implement the Collection, Drainage, and Treatment Components Inspection Program, as described in LRA Section B.2.9.	A.1.9 B.2.9 and Response to NRC RAI A.1-1 from NRC letter dated	Prior to October 22, 2016	LRA and FENOC letter L-13-160

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
		March 26, 2013		
5	Implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection as described in LRA Section B.2.11. Enhance the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Inspection to include high-voltage connections to confirm the absence of aging effects for metallic electrical connections.	A.1.11 B.2.11 Response to NRC RAI 3.6-3 from NRC letter dated April 5, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-134 and L-13-160
6	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, as described in LRA Section B.2.12.	A.1.12 B.2.12 and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
7	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, as described in LRA Section B.2.13.	A.1.13 B.2.13 and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
8	Enhance the External Surfaces Monitoring Program to do the following: • Add systems that credit the program for license renewal but do not have Maintenance Rule intended functions to the scope of the program. • Perform opportunistic inspections of surfaces that are inaccessible or not readily visible during normal plant operations or refueling outages, such as surfaces that are insulated. Surfaces that are accessible will be inspected at a frequency not to exceed one refueling cycle. • Perform, in conjunction with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, inspection and surveillance of elastomers and polymers exposed to air-indoor uncontrolled or air-outdoor environments, but not replaced on a set frequency or interval (i.e., are long-lived), for evidence of cracking and change in material properties	A.1.15 B.2.15 and Responses to NRC RAIs 3.3.2.2.5-1 and B.2.2-2 from NRC letter dated April 20, 2011, NRC RAI 3.3.2-2 from NRC letter dated May 2, 2011, RAI 3.3.2.2.5-2 from NRC letter dated July 12, 2011,	Prior to October 22, 2016	LRA and FENOC letters L-11-153, L-11-166, L-11-238, and L-13-160

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	(hardening and loss of strength) and loss of material due to wear. Specify acceptance criteria of no unacceptable visual indications of cracks or discoloration that would lead to loss of function prior to the next inspection, and of no hardening as evidenced by a loss of suppleness during manipulation. • Perform inspection of the control room emergency ventilation system air-cooled condensing unit cooling coil tubes and fins and the station blackout diesel generator radiator tubes and fins for visible evidence of external surface conditions that could result in a reduction in heat transfer. Specify acceptance criteria of no unacceptable visual indications of fouling (build up of dirt or other foreign material) that would lead to loss of function prior to the next scheduled inspection. • Manage cracking of copper alloys with greater than 15% zinc and stainless steel components exposed to an outdoor air environment through plant system inspections and walkdowns for evidence of leakage. Specify acceptance criteria of no unacceptable visual indications of cracks that would lead to loss of function prior to the next scheduled inspection. • Include inspection parameters and acceptance criteria for polymers, elastomers and metallic components as applicable in system inspection and walkdown documentation. • Retain system inspection and walkdown documentation in plant records.	and Supplemental RAI OIN-352 from NRC Region III IP-71002 Inspection and RAI A.1-1 from NRC letter dated March 26, 2013		
9	Enhance the Fatigue Monitoring Program to do the following: • Provide for updates of the fatigue usage calculations on an as needed basis if an allowable cycle limit is approached. When the number of accrued cycles is within 75% of the allowable cycle limit for any transient, a condition report will be generated. For any transient whose cycles are projected to exceed the allowable cycle limit by the end of the next plant operating cycle (Davis Besse operating cycles are normally two 2 years in duration), the program will require an update of the fatigue usage calculation for the affected component(s). • Establish an acceptance criterion for maintaining the cumulative fatigue usage below the Code design limit of 1.0 through the period of extended operation, including environmental effects where applicable.	A.1.16 B.2.16 Responses to NRC RAIs B.2.16-3, B.2.16-4 and B.2.16-5 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-11-166 and L-13-160
10	Enhance the Fire Water Program to do the following: • Perform periodic ultrasonic testing for wall thickness of representative	A.1.18 B.2.18	Prior to October 22, 2016	LRA

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	above-ground water suppression piping that is not periodically flow tested but contains, or has contained, stagnant water. The ultrasonic testing will be performed prior to the period of extended operation and at appropriate intervals thereafter, based on engineering evaluation of the initial results. • Perform at least one opportunistic or focused visual inspection of the internal surface of buried fire water piping and of similar above-ground fire water piping, within the 5-year period prior to the period of extended operation, to confirm whether conditions on the internal surface of above-ground fire water piping can be extrapolated to be indicative of conditions on the internal surface of buried fire water piping. • Perform representative sprinkler head sampling (laboratory field service testing) or replacement prior to 50 years in-service (installed), and at 10-year intervals thereafter, in accordance with NFPA 25, or until there are no untested sprinkler heads that will see 50 years of service through the end of the period of extended operation. • Perform opportunistic fire water supply and water-based suppression system internal inspections each time a fire water supply or water-based suppression system (including fire pumps) is breached for repair or maintenance. These internal visual inspections must be demonstrated to be representative of water supply and water-based suppression locations, performed on a reasonable basis (frequency), and capable of evaluating wall thickness and flow capability. If the internal inspections cannot be completed of a representative sample, then ultrasonic testing inspections will be used to complete the representative sample.	and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013		and FENOC letter L-13-160
11	Implement the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, as described in LRA Section B.2.21. Enhance the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program to do the following: • Include inaccessible underground lower service voltage cables (400 VAC to 2 kV). • Not use ‘significant voltage’ (defined as being subjected to system voltage for more than 25% of the time) as a criterion for inclusion into the program. • Include inspection of electrical manholes which contain power cables within the scope of the program.	A.1.21 B.2.21 Responses to NRC RAIs B.2.21-1 and B.2.21-3 from NRC letter dated April 5, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-134 and L-13-160

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	• Inspect electrical manholes at least once per year. The frequency of inspections for accumulated water will be established and adjusted based on plant-specific inspection results. Also, manhole inspections will be performed in response to event-driven occurrences (e.g., heavy rain or flooding). • Include a requirement in preventive maintenance activities PM 4297, PM 4294, PM 8025, and PM 4296 to generate a condition report in cases where in scope inaccessible non-EQ power cable manhole inspection identifies submerged cables. Although the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program, preventive maintenance activities exist for inspection of water accumulation in the manholes associated with the in scope inaccessible non-EQ power cables. • Perform cable testing on a frequency of at least every 6 years. Testing will be evaluated for more frequent performance based on test results and operating experience.			
12	Enhance the Masonry Wall Inspection to do the following: • Include and list the structures within the scope of license renewal that credit the program for aging management. • Add an action to follow the documentation requirement of 10 CFR 54.37, including submittal of records of structural evaluations to records management. • Specify that for each masonry wall, the extent of observed masonry cracking or degradation of steel edge supports or bracing is evaluated to ensure that the current evaluation basis is still valid. Corrective action is required if the extent of masonry cracking or steel degradation is sufficient to invalidate the evaluation basis. An option is to develop a new evaluation basis that accounts for the degraded condition of the wall (i.e., acceptance by further evaluation). • Specify that for the masonry walls within the scope of license renewal, inspections will be conducted at least once every 5 years, with provisions for more frequent inspections in areas where significant loss of material or cracking is observed to ensure there is no loss of intended function between inspections.	A.1.27 B.2.27 Response to NRC RAI B.2.39-5 from NRC letter dated April 5, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-11-153 and L-13-160
13	Implement the One-Time Inspection, as described in LRA Section B.2.30.	A.1.30	Prior to	LRA

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	Enhance the One-Time Inspection to include enhanced visual (EVT-1 or equivalent) or surface examination (magnetic particle, liquid penetrant), or volumetric (RT or UT) inspections to detect and characterize cracking due to cyclic loading of the stainless steel makeup pump casings (DB-P37-1 and 2) of the makeup and purification system. The one-time inspections will provide verification of the absence of cracking due to cyclic loading.	B.2.30 Responses to NRC RAI 3.3.2.2.4.3-1 from NRC letter dated May 2, 2011, Supplemental Question—Makeup Pump Casing Inspections, and RAI A.1-1 from NRC letter dated March 26, 2013	October 22, 2016	and FENOC letters L-11-153, L-11-166, L-11-218, L-11-237, L-11-252, and L-13-160
14	Implement the PWR Reactor Vessel Internals Program, as described in LRA Section B.2.32.	A.1.32 B.2.32 and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
15	In association with the PWR Reactor Vessel Internals Program, a plant-specific inspection plan for ensuring the implementation of MRP-227 program guidelines, as amended by the safety evaluation for MRP-227, and Davis-Besse's responses to the plant-specific action items, as identified in Section 4.2 of the safety evaluation for MRP-227, will be submitted for NRC review and approval. * NOTE: The inspection plan will be submitted no later than 2 years after issuance of the renewed operating license or 2 years prior to the beginning of the period of extended operation (April 22, 2015), whichever is earlier.	A.1.32 B.2.32 and Response to NRC RAI B.2.32-1 from NRC letter dated July 11, 2011	Prior to April 22, 2015 *	LRA and FENOC letter L-11-252
16	Enhance the Reactor Head Closure Studs Program as follows: • Select an alternate stable lubricant that is compatible with the fastener material and the environment. A specific precaution against the use of compounds containing sulfur (sulfide), including molybdenum disulfide (MoS_2), as a lubricant for the reactor head closure stud assemblies will be included in the program. • Preclude the future use of replacement closure stud bolting fabricated from material with actual measured yield strength greater than or equal to 150 ksi	A.1.34 B.2.34 and Response to NRC RAI B.2.34-1 from NRC letter dated June 20, 2011, and RAI A.1-1 from NRC letter dated	Prior to October 22, 2016	LRA and FENOC letters L-11-218 and L-13-160

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	except for use of the existing spare reactor head closure stud bolting.	March 26, 2013		
17	Enhance the Reactor Vessel Surveillance Program as follows: • The Capsule Insertion and Withdrawal Schedule for Davis-Besse will be revised to schedule testing of the TE1-C capsule.	A.1.35 B.2.35 and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
18	Implement the Selective Leaching Inspection, as described in LRA Section B.2.36.	A.1.36 B.2.36 and Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
19	Implement the Small Bore Class 1 Piping Inspection, as described in LRA Section B.2.37.	A.1.37 B.2.37 Response to NRC RAI B.2.37-2 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Completed within the 6-year period prior to October 22, 2016	LRA and FENOC letters L-11-153 and L--13-160
20	Enhance the Structures Monitoring Program to do the following: • Include and list the structures within the scope of license renewal that credit the program for aging management. • Include aging effect terminology (e.g., loss of material, cracking, change in material properties, and loss of form). • List ACI 349.3R and ANSI/ASCE 11-90 as references and indicate that they provide guidance for the selection of parameters monitored or inspected. • Clarify that a “structural component” for inspection includes each of the component types identified within the scope of license renewal as requiring aging management. • Require the responsible engineer to review site raw water pH, chlorides, and sulfates test results prior to the inspection to take into account the raw	A.1.39 B.2.39 Responses to NRC RAIs B.2.39-4, B.2.39-5, B.2.39-6 and B.2.39-7 from NRC letter dated April 5, 2011, B.2.39-11 and 3.5.2.3.12-4 from NRC letter dated July 21, 2011, Supplemental RAI B.2.39-11 from telecon held with the NRC on September 13, 2011, Supplemental RAI OIN-380	Prior to October 22, 2016	LRA FENOC letters L-11-153, L-11-237, L-11-292, L-11-317, L-12-455, L-13-037 and L-13-160

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	water chemistry for any unusual trends during the period of extended operation. Raw water chemistry data shall be collected at least once every 5 years. Data collection dates shall be staggered from year to year (summer-winter-summer) to account for seasonal variation. • Perform an inspection for loss of material for carbon steel structural components subject to aggressive groundwater. Require the use of the FENOC Corrective Action Program for identified concrete or steel degradation. • Specify that, upon notification that a below-grade structural wall or other in-scope concrete or metal structural component will become accessible through excavation, a followup action is initiated to the responsible engineer to inspect the exposed surfaces for age-related degradation. Such inspections will include concrete examination using acceptance criteria from NUREG-1801, XI.S6, program element 6. Degradation found that exceeds the acceptance criteria will be trended and processed through the FENOC Corrective Action Program. • List ACI 349.3R, ANSI/ASCE 11-90, and EPRI Report 1007933 as references and indicate that they provide guidance for detection of aging effects. • Add an action to follow the documentation requirement of 10 CFR 54.37, including submittal of records of structural evaluations to records management. • Revise to add sufficient acceptance criteria and critical parameters to trigger an increased level of inspection and initiation of corrective action. Indicate that ACI 349.3R provides acceptable guidelines which will be considered in developing acceptance criteria for concrete structural elements, steel liners, joints, and waterproofing membranes. The acceptance criteria for visual inspection of coatings on in-scope concrete structures will be in accordance with ACI 349.3R. Plant-specific quantitative degradation limits, similar to the three-tier hierarchy acceptance criteria from Chapter 5 of ACI 349.3R, will be developed and added to the inspection procedure. The Structures Monitoring Program procedure will also be enhanced to reflect the "Periodic Evaluation" criteria defined in Chapter 3.3 of ACI 349.3R. The Structures Monitoring Program procedure will include the "prioritization process" to develop a representative sample of areas to inspect in accordance with ACI 349.3R. • Require that personnel performing the structural inspections meet	from Region III IP-71002 Inspection. RAI B.2.4-1a from NRC letter dated November 14, 2012, RAI B.2.43-3a from NRC letter dated January 4, 2013, and RAI A.1-1 from NRC letter dated March 26, 2013		

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	qualifications that are commensurate with ACI 349.3R, “Evaluation of Existing Nuclear Safety-Related Concrete Structures,” Chapter 7, “Qualifications of Evaluation Team.” • The program procedure will be enhanced by specifying that, for the structures within the scope of license renewal, inspections will be conducted at least once every 5 years. • Conduct a baseline inspection of the structures within the scope of license renewal prior to entering the period of extended operation. • Require optical aids, scaling technologies, mechanical lifts, ladders or scaffolding for tall structures or difficult to reach areas of structures to allow visual inspections that meet the guidelines of Chapter 5 of ACI 349.3R. Select the areas to be inspected in accordance with the guidelines of Chapter 5 of ACI 349.3R to reflect the “Periodic Evaluation” criteria defined in Chapter 3.3 of ACI 349.3R. Include the “prioritization process” in the selection methodology to develop a representative sample of areas to inspect in accordance with ACI 349.3R. • Monitor elastomeric vibration isolators and structural sealants for cracking, loss of material, and hardening. • Supplement visual inspection of elastomeric vibration isolation elements by feel to detect hardening if the vibration isolation function is suspect. • Identify that the following are true: – Loose bolts and nuts and cracked high strength bolts are not acceptable unless accepted by engineering evaluation. – Structural sealants are acceptable if the observed loss of material, cracking, and hardening will not result in loss of sealing. – Elastomeric vibration isolation elements are acceptable if there is no loss of material, cracking, or hardening that could lead to the reduction or loss of isolation function. • Require that high strength (i.e., ASTM A540 Grade B23) structural bolting materials with an actual measured yield strength greater than or equal to 150 ksi and greater than 1 inch in nominal diameter are monitored for stress corrosion cracking (SCC). Perform periodic visual inspections of susceptible ASTM A540 bolting to identify locations where A540 bolting may be exposed to a potentially corrosive environment for SCC. Complete the initial visual inspections prior to entering the period of extended operation,			

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	and perform recurring inspections at an interval not to exceed five years. Perform volumetric examination (i.e., ultrasonic testing) on a sampling basis of bolting exposed to a corrosive environment, as determined by engineering evaluation, to a depth of at least 12 inches. • Require that personnel performing ultrasonic testing (UT) examinations of structural bolting have a current ASME Code Section XI, Appendix VIII, Supplement 8 endorsement. • Revise the applicable structural bolting specifications to prevent future use of A540 bolting with measured yield strength equal to or exceeding 150 ksi.			
21	Enhance the Water Control Structures Inspection to do the following: • Include the service water discharge structure, which is within the scope of license renewal. • Include parameters monitored and inspected for water control structures, including the service water discharge structure, in accordance with applicable inspection elements listed in Section C.2 of Regulatory Guide 1.127, Revision 1. Descriptions of concrete conditions will conform with the appendix to ACI 201. The use of photographs for comparison of previous and present conditions will be included as a part of the inspection program. • Specify that water control structure periodic inspections are to be performed at least once every 5 years. • Add an action to follow the documentation requirement of 10 CFR 54.37, including submittal of records of structural evaluations to records management. • Add sufficient acceptance criteria and critical parameters to trigger an increased level of inspection and initiation of corrective action. Indicate that ACI 349.3R provides acceptable guidelines which will be considered in developing acceptance criteria for water control structures. Plant-specific quantitative degradation limits, similar to the three-tier hierarchy acceptance criteria from Chapter 5 of ACI 349.3R, will be developed and added to the inspection procedure. The Structures Monitoring Program procedure will also be enhanced to reflect the "Periodic Evaluation" criteria defined in Chapter 3.3 of ACI 349.3R. The Structures Monitoring Program procedure will include the "prioritization process" to develop a representative sample of areas to inspect in accordance with ACI 349.3R.	A.1.40 B.2.40 Responses to NRC RAI B.2.39-6 from NRC letter dated April 5, 2011, Supplemental RAI OIN-379 from Region III IP-71002 Inspection, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153, L-11-292, and L-13-160

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	• Conduct a baseline inspection of the structures within the scope of license renewal prior to entering the period of extended operation. • Require that loose bolts and nuts, cracked high strength bolts, and degradation of piles and sheeting (sheet pilings) are accepted by engineering evaluation or subject to corrective actions. Engineering evaluation will be documented and based on codes, specifications and standards such as American Institute of Steel Construction (AISC) specifications, Structural Engineering Institute / American Society of Civil Engineers (SEI/ASCE) 11, and codes, specifications or standards referenced in the Davis-Besse current licensing basis.			
22	Enclose or otherwise protect the safety-related station ventilation radiation monitors located in the turbine building such that leakage and spray from surrounding piping systems does not adversely impact the intended function of the radiation monitors.	Response to NRC RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-13-160
23	In association with the TLAA for effects of environmentally assisted fatigue of the high-pressure injection (HPI) nozzle safe end including the associated Alloy 82/182 weld (weld that connects the safe end to the nozzle), replace the HPI nozzle safe end including the associated Alloy 82/182 weld for all four HPI nozzles prior to the period of extended operation. Apply the Fatigue Monitoring Program to evaluate the environmental effects and manage cumulative fatigue damage for the replacement HPI nozzle safe ends and associated welds.	A.2.3.4.2 A.2.7.4 Responses to NRC RAIs 4.7.4-1 from NRC letter dated April 15, 2011, 4.3-18 from NRC letter dated June 17, 2011, RAI 4.7.4-1 from NRC letter dated October 11, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-107, L-11-203, L-11-334, and L-13-160
24	Apply the elements of corrective actions, confirmation process, and administrative controls in the Quality Assurance Program Manual to the credited AMPs and activities for safety-related and nonsafety-related structures and components determined to require aging management for the period of extended operation.	A.1 Response to NRC RAI 3.0 from NRC letter dated May 2, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-11-166 and L-13-160
25	Enhance the Steam Generator Tube Integrity Program to do the following: • Include gross visual inspection of the steam generator tube-to-tubesheet welds coupled with eddy-current inspection (i.e., bobbin coil or rotating coil	A.1.38 B.2.38 Responses to NRC	Prior to October 22, 2016	LRA and

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	examinations) of the tubes to monitor for cracking and degradation of the tube-to-tubesheet welds (Alloy 600). Schedule the gross visual inspection of the tube-to-tubesheet welds concurrent with eddy-current inspection of the steam generator tubes that are scheduled in accordance with Davis-Besse Technical Specification 5.5.8 such that 100 % of the tube-to-tubesheet welds (includes both the hot leg and cold leg welds) are inspected at sequential periods of 60 effective full power months. Perform the gross visual inspection of the tube-to-tubesheet welds through remote-visual examination using a manipulator camera to obtain a straight-on view of the weld with a visual acuity sufficient to detect evidence of degradation. Perform the gross visual inspections using personnel who are qualified for American Society of Mechanical Engineers (ASME) code visual examination (i.e., are certified VT-1 or VT-3 examiners) and are knowledgeable in the type of tube-to-tubesheet welds being examined (i.e., fillet welds). Define the acceptance criteria for the gross visual inspections and the eddy-current inspections as no indication of cracking or relevant conditions of degradation.	RAIs 3.1.2.2.16-2 from NRC letter dated November 8, 2011, RAI 3.1.2.2.16-3 from NRC letter dated December 27, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013		FENOC letters L-11-354, L-12-001, and L-13-160
26	• Obtain and evaluate for degradation a concrete core bore from two representative inaccessible concrete components of an in-scope structure subjected to aggressive groundwater prior to entering the period of extended operation. Based on the results of the initial core bore sample, evaluate the need for collection and evaluation of representative concrete core bore samples at additional locations that may be identified during the period of extended operation as having aggressive groundwater infiltration. • Select additional core bore sample locations based on the duration of observed aggressive groundwater infiltration. • Document identified concrete or steel degradation in the FENOC Corrective Action Program.	Responses to NRC RAI B.2.39-3 from NRC letter dated April 5, 2011, RAI B.2.39-11 from NRC letter dated July 21, 2011, and Supplemental RAI B.2.39-11 from telecon held with the NRC on September 13, 2011	Prior to December 31, 2014	FENOC letters L-11-153, L-11-237, and L-11-292
27	Davis-Besse Surveillance Test Procedure DB-PF-03009, Revision 06, “Containment Vessel and Shielding Building Visual Inspection,” Subsection 2.1.2, shall be enhanced to state, Personnel who perform general visual examinations of the exterior surface of the Containment Vessel and the interior and exterior surfaces of the Shield Building shall meet the requirements for a general visual examiner in accordance with Nuclear Operating Procedure NOP-CC-5708, “Written Practice for the Qualification and Certification of Nondestructive Examination Personnel.” These individuals shall be knowledgeable of the types of conditions which may be expected to be identified during the	Response to NRC RAI B.2.1-1 from NRC letter dated April 5, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	FENOC letters L-11-134 and L-13-160

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	examinations.			
28	Enhance the Fuel Oil Chemistry Program to do the following: • Require that internal surfaces of emergency diesel generator fuel oil storage tanks and day tanks, diesel oil storage tank, diesel fire pump day tank, and station blackout diesel generator day tank are periodically drained (at least once every 10 years) for cleaning and are visually inspected to detect potential degradation. If degradation is identified in a diesel fuel tank by visual inspections, a volumetric inspection is performed. • Require that biological activity be monitored and trended at least quarterly.	A.1.20 B.2.20 Responses to NRC RAIs B.2.20-1 and B.2.20-2 from NRC letter dated April 5, 2011, Supplemental RAI OIN-368 from NRC Region III IP-71002 Inspection, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-134, L-11-238, and L-13-160
29	Enhance the Cranes and Hoists Inspection Program to include visual inspections for loose bolts and missing or loose nuts in crane, monorail, and hoist inspection procedures at the same frequency as inspections of rails and structural components.	A.1.10 B.2.10 Response to NRC RAI B.2.10-2 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letter L-11-153 and L-13-160
30	Enhance the Leak Chase Monitoring Program to do the following: • Include acceptance criteria such that measurement of leakage from any monitoring line exceeding 15 ml/min will be documented in the Corrective Action Program for evaluation and potential corrective actions. Evaluation will include consideration of more frequent monitoring. • Analyze collected leak chase drainage for pH monthly and for iron every 6 months. The initial acceptance criteria will be 7.0–8.0 for pH. The results for iron will be monitored and trended to insure that there is no indication of corrosion of the reinforcing bars in the walls or floor of the pool and pits. An acceptance criterion for the iron analyses will be developed after 3 years of measurements. Analyses that exceed the limits will be documented in the Corrective Action Program. • Perform the leak chase inspection and cleaning recurring preventive maintenance (PM) activity every 18 months.	A.1.25 B.2.25 Responses to NRC RAI B.2.25-5 from NRC letter dated April 5, 2011, and RAIs B.2.25-7, RAI B.2.39-10 from NRC letter dated July 21, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153, L-11-238, and L-13-160

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	• Inspect once per year for leakage migrating through the accessible outside walls and floor (from the ceiling side) of the pool and pits. Document the inspection results and retain in plant records. Indication of leakage through the walls will be documented in the Corrective Action Program.			
31	Incorporate reference to and the preventative actions of the Research Council for Structural Connections, "Specification for Structural Joints Using ASTM A325 or A490 Bolts" into the Davis-Besse specifications and implementing procedures that address Davis-Besse structural bolting within the scope of license renewal.	Response to NRC RAI B.2.39-8 from NRC letter dated April 5, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	FENOC letters L-11-153 and L-13-160
32	Enhance the Closed Cooling Water Chemistry program to do the following: • Document the results of periodic inspections of opportunity, performed when components are opened for maintenance, repair, or surveillance. • Ensure that a representative sample of piping and components will be inspected on a 10-year interval, with the first inspection taking place prior to entering the period of extended operation. • Ensure that component cooling water radiochemistry is sampled on a weekly interval to verify the integrity of the letdown coolers and seal return coolers.	A.1.8 B.2.8 Response to NRC RAI B.2.8-1 from NRC letter dated April 20, 2011, Supplemental RAI 2.3.3.18-4 from telephone conference held on November 9, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153, L-11-354, and L-13-160
33	Phase 1 Perform the following actions to reduce or mitigate the refueling canal leaks inside containment: 1. Select and implement a leak detection method to locate the leakage area. 2. Evaluate temporary and permanent repair methods to stop or significantly reduce the leakage, and implement a repair plan. Phase 2 Perform the following actions to evaluate the impact of refueling canal leaks on concrete and reinforcing steel structures. Discontinue core bores, testing and reinforcing steel inspections when indications of refueling canal leakage are no longer present: 1. Perform a core bore in the south wall of the east-west section of the core flood pipe tunnel.	Response to NRC RAI B.2.39-9 from NRC letter dated July 27, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Phase 1: Action 1 prior to December 31, 2014 Action 2 prior to October 22, 2016 Phase 2: Action 1 prior to December 31, 2014	FENOC letters L-11-252 and L-13-160

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	a. Assess borated water degradation of the concrete by testing the core bore sample for compressive strength and by petrographic examination and evaluate the results. b. Conduct a visual examination of the concrete and reinforcing steel to identify aging effects (e.g., concrete degradation or steel corrosion). Enter identified aging effects into the FENOC Corrective Action Program and evaluate in accordance with the requirements of the current licensing basis Maintenance Rule Program. 2. If leakage from the refueling canal has not been eliminated or resumes by the beginning of the period of extended operation, then evaluate the concrete structures in a manner similar to the way that they were evaluated under Phase 2, Action 1. However, use acceptance criteria from the ACI 349.3R for the evaluation. 3. If leakage from the refueling canal has not been eliminated or resumes during the period of extended operation, then evaluate the concrete structures again in a manner similar to the way that they were evaluated under Phase 2, Action 2. Perform evaluations every 10 years until the end of the period of extended operation.		Action 2 prior to December 31, 2023 Action 3—Ongoing	
34	Enhance the Bolting Integrity Program to do the following: • Select an alternate stable lubricant that is compatible with the fastener material and the environment. A specific precaution against the use of compounds containing sulfur (sulfide), including MoS_2, as a lubricant will be included in the program.	A.1.4 B.2.4 Response to NRC RAI B.2.4-3 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153 and L-13-160
35	Perform the following actions for each of two examinations (Phase 1 and Phase 2) of the containment vessel in the sand pocket region: • Perform nondestructive examination (NDE) of the containment vessel from the outer surface at five areas of previously-identified groundwater in-leakage. – Examine the vessel at a minimum of three vertical grid locations at 12 in. nominal horizontal spacing at each area. Examine the containment vessel at a minimum of three elevations: 1. approximately 3 in. below the existing grout-to-vessel interface in the	Response to NRC RAI B.2.22-5 from NRC letter dated July 21, 2011	Phase 1 prior to December 31, 2014 and Phase 2 prior to December 31,	FENOC letter L-11-252

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	sand pocket region 2. at the existing grout-to-vessel interface level in the sand pocket region 3. approximately 3 in. above the existing grout-to-vessel interface in the sand pocket region • Compare the ultrasonic test (UT) thickness readings to minimum ASME Code vessel thickness requirements and to the results obtained during previous UT examinations of the containment vessel and determine the need for maintenance or repair of the containment vessel based on the results and evaluation of the examinations. • Document the results of each of the two examinations in the work order system. • Document and evaluate adverse conditions in accordance with the FENOC Corrective Action Program for an evaluation of potential degradation of the steel containment vessel thickness over the longer term.		2025	
36	Perform the following actions related to the containment vessel sand pocket region each refueling outage: • Perform visual inspection of 100% of the accessible areas of the wetted outer surface of the containment vessel in the sand pocket region. • Perform visual inspection of accessible dry areas of the outer surface of the containment vessel in the sand pocket region and the areas above the grout-to-steel interface up to elevation 566 feet + 3 in., - 1 in. • Perform visual inspection for deterioration (e.g., missing or damaged grout) of accessible grout and the containment exterior moisture barrier in the sand pocket area. • Perform opportunistic visual inspections of inaccessible areas of the containment vessel in the sand pocket region when such areas are made accessible. • Perform opportunistic visual inspections for deterioration (e.g., missing or damaged grout) of inaccessible grout in the sand pocket region when such areas are made accessible. Inaccessible grout is the grout below the normally-exposed surface of the grout in the sand pocket area. • Address issues of pitting, microbiologically-influenced corrosion (MIC),	Response to NRC RAI B.2.22-5 from NRC letter dated July 21, 2011 and Supplemental RAI B.2.22-5 from telephone conferences held on October 5 and November 14, 2011	Ongoing	FENOC letter L-11-252 and L-11-354

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	degraded grout, moisture barrier or sealant identified during the inspections using the FENOC Corrective Action Program. • Sample the water in the sand pocket region when sufficient volumes are available. The number of sampled water volumes will be determined by the number of water volumes observed and the size of those water volumes. Analyze the sample(s) for pH, chlorides, iron and sulfates. Treat or wash (or a combination thereof) the sand pocket area to reduce measured chloride concentrations to less than 250 parts per million (ppm) if the concentration of chlorides in a sample exceeds 250 ppm. Note: Water samples may be taken at different times during each outage. Engineering judgment may be used to determine the priority of the chemical analyses to be performed if sufficient water is not available in a given sample for all analyses.			
37	Perform and evaluate core bores of the ECCS Pump Room No. 1 wall and the Room 109 ceiling. • The core bores will be deep enough to expose reinforcing bar in the wall and ceiling. The core samples from the core bores will be examined for signs of corrosion or chemical effects of boric acid on the concrete or reinforcing bars. The examination will include a petrographic examination. The reinforcing steel that will be exposed for a visual inspection will have corrosion products collected for testing. Degradation identified from the samples will be entered into the FENOC Corrective Action Program. The core bores will be performed in areas where leakage has been observed in the past. • The first set of core bores will be performed prior to the end of 2014 (Phase 1). • The second set of core bores will be performed prior to the end of 2020 (Phase 2). • Further core bores will be conducted, if warranted, based on the evaluation of the results of the inspection and testing of the core bores or if spent fuel pool leakage through the wall or ceiling recurs after the second set of core bores is performed. If spent fuel pool leakage through another wall or ceiling is identified, then core bores will be performed in a manner similar to that stated for the ECCS Pump Room No. 1 wall and the Room 109 ceiling.	Responses to NRC RAI B.2.39-2 from NRC letter dated April 5, 2011, and RAI B.2.39-10 from NRC letter dated July 21, 2011	Phase 1 prior to December 31, 2014 and Phase 2 prior to December 31, 2020	FENOC letters L-11-153 and L-11-238
38	Evaluate the concrete cracking observed on the underside of the spent fuel pool for necessary repairs.	Responses to NRC RAI B.2.39-2 from NRC letter	Prior to October 22, 2016	FENOC letters L-11-153,

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	Note: A core bore of the Room 109 ceiling will be performed by the end of 2014 (see license renewal commitment 37). Degradation identified from the samples will be entered into the FENOC Corrective Action Program. The condition of the concrete and the reinforcing steel will be evaluated at that time to assist in determining what repairs, if any, need to be made to the underside of the spent fuel pool concrete. The criterion for determining the need to repair the cracking will be the continued capability of the structures to perform their intended functions during the period of extended operation.	dated April 5, 2011, RAI B.2.39-10 from NRC letter dated July 21, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013		L-11-238, and L-13-160
39	Address the potential for borated water degradation of the steel containment vessel through the following actions: • Access the inside surface of the embedded steel containment at a vertical height no greater than 10 inches above bottom dead center. A core bore will be completed by the end of 2014 (Phase 1). • If necessary, a second core bore will be completed by the end of 2020 (Phase 2). • If there is evidence of the presence of borated water in contact with the steel containment vessel, conduct NDT to determine what effect, if any, the borated water has had on the steel containment vessel. • Based on the results of NDT, perform a study to determine the effect through the period of extended operation of any identified loss of thickness in the steel containment due to exposure to borated water.	Responses to NRC RAIs B.2.22-2 from NRC letter dated April 5, 2011, RAI B.2.22-6 from NRC letter dated July 27, 2011, and Supplemental RAI B.2.22-6 from NRC telephone conference call held on May 9, 2013	Phase 1 prior to December 31, 2014 and Phase 2 prior to December 31, 2020	FENOC letters L-11-153, L-11-237, and L-13-180
40	Implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Program, as described in LRA Section B.2.41.	A.1.41 B.2.41 Responses to NRC RAIs 3.3.2.2.5-1 and 3.3.2.71-2 from NRC letter dated April 20, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-153 and L-13-160
41	Establish a preventive maintenance task to periodically replace the flexible connections exposed to fuel oil in the fuel oil system.	Response to NRC RAI 3.3.2.3.12-2 from NRC letter dated May 2, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	FENOC letters L-11-166 and L-13-160

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42	Enhance the Fatigue Monitoring Program to do the following: • Evaluate additional plant-specific component locations in the reactor coolant pressure boundary that may be more limiting than those considered in NUREG/CR-6260. This evaluation will include identification of the most limiting fatigue location exposed to reactor coolant for each material type (i.e., CS, LAS, SS, and NBA) and that each bounding material/location will be evaluated for the effects of the reactor coolant environment on fatigue usage. Nickel based alloy items will be evaluated using NUREG/CR-6909. • Submit the evaluation to the NRC 1 year prior to the period of extended operation.	A.1.16 B.2.16 Response to NRC RAI B.2.16-2 from NRC letter dated April 20, 2011	Prior to April 22, 2016	LRA and FENOC letter L-11-166
43	Ensure that the current station operating experience review process includes future reviews of plant-specific and industry operating experience to confirm the effectiveness of the license renewal AMPs to determine the need for programs to be enhanced, or indicate a need to develop new AMPs.	Response to NRC RAI B.1.4-1 from NRC letter dated May 19, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Complete	FENOC letters L-11-188 and L-13-160 L-13-257
44	Cathodically protect the EDG fuel oil storage tanks (DB-T153-1 and DB-T153-2) and the in-scope fuel oil and service water buried piping in accordance with NACE SP0169-2007 or NACE RP0285-2002.	Response to NRC RAI B.2.7-1 from NRC letter dated April 20, 2011, as modified per telecon with the NRC held on June 7, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	FENOC letter L-11-203 L-11-218, and L-13-160
45	Implement the Nuclear Safety-Related Coatings Program, as described in LRA Section B.2.42.	A.1.42 B.2.42 Response to NRC RAI XI.S8-1 from NRC letter dated April 5, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-203, L-11-218, and L-13-160
46	Implement the Shield Building Monitoring Program as described in LRA Section B.2.43.	A.1.43 B.2.43 Response to NRC RAI B.2.39-13 from NRC Letter dated	Prior to October 22, 2016	FENOC letters L-12-028 and L-13-160

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
		December 27, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013		
47	Enhance the Inservice Inspection (ISI) Program—IWE to include surface examinations to monitor for cracking of containment stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no current licensing basis fatigue analysis. The inspection sample size will include 10% of the containment penetration population that are subject to cyclic loading but have no current licensing basis fatigue analysis. Penetrations included in the inspection sample will be scheduled for examination in each 10-year ISI interval that occurs during the period of extended operation. Should fatigue analyses be performed in the future for the subject containment penetrations, the surface examinations will no longer be required.	A.1.22 B.2.22 Responses to NRC RAI B.2.22-7 from NRC letter dated July 21, 2011, Supplemental RAI B.2.22-7 from NRC Telecons on September 13 and 16, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-238, L-11-292, and L-13-160
48	Complete an investigation and needed repairs or modification of the degraded portion of the safety-related intake canal embankment.	Response to NRC RAI B.2.40-2 from NRC letter dated July 21, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	FENOC letters L-11-238 and L-13-160
49	Enhance the Nickel-Alloy Management Program to provide for inspection of dissimilar metal butt welds in accordance with the requirements of ASME Code Case N-770-1, "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 Application of Listed Mitigation Activities, Section XI, Division 1," as modified by 10 CFR 50.55a(g)(6)(ii)(F).	A.1.28 B.2.28 Response to NRC RAI B.2.28-1 from NRC letter dated July 27, 2011, and RAI A.1-1 from NRC letter dated March 26, 2013	Prior to October 22, 2016	LRA and FENOC letters L-11-238 and L-13-160
50	Enhance the Inservice Inspection (ISI) Program - IWF to do the following: • Include monitoring of ASTM A490 high-strength bolting (i.e., actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch nominal diameter for cracking using volumetric examination. The volumetric examinations will be performed in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV, 2007 Edition through 2008 Addenda. The representative sample size will be equal to 20 percent (rounded up to the nearest whole number) of the entire IWF population of ASTM A490 high-strength bolts in sizes greater than 1-inch nominal diameter, with a	A.1.23 B.2.23 Supplemental response to NRC RAI B.2.4-1b from NRC letter dated February 14, 2013, and from telephone conference calls held on April 11, April 24, May 2, and May 28, 2013	Prior to October 22, 2016	LRA and FENOC letters L-13-181 and L-13-199

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	maximum sample size of 25 bolts. The selection of the representative sample will consider susceptibility to stress corrosion cracking (SCC) (e.g., actual measured yield strength) and as low as reasonably achievable (ALARA) radiation dose reduction principles. The frequency of examination will be once each 10-year ISI interval beginning with the fourth interval that started on September 21, 2012. • Include monitoring of ASTM A540 high-strength bolting (i.e., actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch in nominal diameter for cracking. Periodic visual inspections of susceptible ASTM A540 bolting will be conducted prior to the period of extended operation and at an interval not to exceed 5 years to identify locations where the A540 bolting may be exposed to a potentially corrosive environment for SCC. If the visual inspections identify one or more bolts in a potentially corrosive environment, then an engineering evaluation will be performed to determine whether the bolting material had been subjected to a corrosive environment for SCC. The bolts determined to have been subiected to a corrosive environment for SCC comprise the population subject to sampling for volumetric examinations. The representative sample size is equal to 20 percent (rounded up to the nearest whole number) of the bolts in the sample population, with a maximum sample size of 25 bolts. The volumetric examinations are performed in accordance with the requirements of ASME Code Section V, Article 5, Appendix IV. Volumetric examinations will be performed no later than the subsequent refueling outage following visual identification of bolting subject to a corrosive environment. Deferral of volumetric examinations to the subsequent refueling outage is not permitted if the visual inspection indicates evidence of contaminant penetration through the coatings. The frequency of examination is once each 10-year ISI interval beginning with the 4th interval that started on September 21, 2012. For ASTM A540 hiqh-strength bolts that are not exposed to a corrosive environment, the volumetric examinations are waived based on plant-specific operating experience associated with the volumetric examination of the Davis-Besse reactor head closure studs (60 each) constructed of high-strength ASTM A540 material where the studs are examined once each ISI interval, and after three intervals, no unacceptable indications have been noted. • As an alternative to the visual examinations and the subsequent volumetric examinations of ASTM A540 bolts subjected to a corrosive environment, the Inservice Inspection (ISI) Program - IWF provides an option to perform periodic volumetric examinations as follows. The program includes monitoring of ASTM A540 high strength bolting (i.e., actual measured yield			

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section No// Comments	Implementation Schedule	Source
	strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch nominal diameter for cracking using volumetric examination. The volumetric examinations are performed in accordance with the requirements of ASME Code Section V, Article 5, Appendix IV. The representative sample size is equal to 20 percent (rounded up to the nearest whole number) of the entire IWF population of ASTM A540 high -strength bolts in sizes greater than 1-inch nominal diameter, with a maximum sample size of 25 bolts. The selection of the representative sample considers susceptibility to SCC (e.g., actual measured yield strength) and ALARA radiation dose reduction principles. The frequency of examination is once each 10-year ISI interval beginning with the 4th interval that started on September 21, 2012.			

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 FirstEnergy Nuclear Operating Company (FENOC or the applicant) and other correspondence regarding the staff's reviews of the Davis-Besse Nuclear Power Station (Davis-Besse), Docket Number 50-346, license renewal application (LRA).

Table B-1. Chronology

Date	Subject
August 27, 2010	Davis-Besse Nuclear Power Station—License Renewal Application and Ohio Coastal Management Program Consistency Certification. (Accession No. ML102450565)
August 27, 2010	Davis-Besse Nuclear Power Station— License Renewal Application Boundary Drawings. (Accession No. ML102460429)
August 31, 2010	License Application for Facility Operating License (Amend/Renewal) DKT 50, FENOC, "Enclosures to Davis-Besse, Unit 1, Letter L-10-221, License Renewal Application, Section 3.5 through Appendix E, References 2.3-1." (Accession No. ML102450563)
August 31, 2010	License Application for Facility Operating License (Amend/Renewal) DKT 50, FENOC, "Enclosures to Davis-Besse, Unit 1, Letter L-10-221, License Renewal Application, Cover Page through Section 3, Page 3.4-112." (Accession No. ML102450567)
August 31, 2010	License Application for Facility Operating License (Amend/Renewal) DKT 50, FENOC, "Enclosures to Davis-Besse, Unit 1, Letter L-10-221, License Renewal Application, Appendix E, Section 2.4 through References E.11." (Accession No. ML102450568)
September 17, 2010	Federal Register Notice: Receipt and Availability of the License Renewal Application for the Davis-Besse Nuclear Power Station, Unit 1. (Accession No. ML102300325)
September 20, 2010	Press Release -10-164: NRC Announces Availability of License Renewal Application for Davis-Besse Nuclear Plant. (Accession No. ML102630380)
October 18, 2010	Letter to Allen B. S., FENOC, "Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from the FirstEnergy Nuclear Operating Company, for Renewal of the Operating License for the Davis-Besse Nuclear Power Station." (Accession No. ML102710584)
October 20, 2010	Federal Register Notice: Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Davis-Besse Nuclear Power Station, Unit 1. (Accession No. ML102700603)
October 26, 2010	Press Release-10-191: NRC Announces Opportunity for Hearing on Application to Renew Operating License for Davis-Besse Nuclear Power Plant. (Accession No. ML102990387)
October 28, 2010	Press Release-10-193: NRC to Conduct Environmental Scoping Meeting as Part of the License Renewal Application for Davis Besse; Meeting November 4, 2010. (Accession No. ML103010069)
November 4, 2010	Meeting Transcript: Davis Besse License Renewal Public Meeting - Afternoon Session. Pages 1-46. (Accession No. ML110140231)
November 4, 2010	Meeting Transcript: Davis Besse License Renewal Public Meeting - Evening Session. Pages 1-3. (Accession No. ML110140232)
November 4, 2010	General FR Notice Comment Letter, from Kucinich D. J., U.S. House of Representatives, to Jaczko G. B., NRC/Chairman , "Comment (10) of Dennis J. Kucinich on Behalf of US House

Date	Subject
	of Representatives, Opposing Davis-Besse for 20-year License Extension" (Accession No. ML110680518)
December 6, 2010	Letter to Kurkul P. A., U.S. Department of Commerce, National Oceanic & Atmospheric Admin (NOAA): Request for List of Protected Species Within the Area Under Evaluation for the Davis-Besse Nuclear Power Station License Renewal Application Review. (Accession No. ML102980692)
December 7, 2010	Letter to Epstein M., State of OH, Historic Preservation Office: Davis-Besse Nuclear Power Station, Unit 1, License Renewal Application Review. (Accession No. ML102980687)
December 21, 2010	Letter from Colligan M.A.,NOAA: Letter dated December 6, 2010, Requesting Information on the Presence of Listed Species in the Vicinity of the Davis-Besse Nuclear Power Station, Located 25 miles East of Toledo, Ohio. (Accession No. ML110140230)
February 3, 2011	Press Release-11-016: Licensing Board to Hear Oral Argument March 1 on Davis-Besse Reactor License Renewal Application. (Accession No. ML110340176)
February 17, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Fire Protection (TAC No. ME4640). (Accession No. ML110450046)
February 24, 2011	Letter to Allen B. S., FENOC: Davis-Besse Nuclear Power Station, Information Request for an NRC License Renewal Inspection. (Accession No. ML110550916)
February 28, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Section 2.4 (TAC No. ME4640). (Accession No. ML110420597)
February 28, 2011	Letter to Allen B. S., FENOC: Environmental Site Audit Regarding Davis-Besse Nuclear Power Station, Unit Number 1, License Renewal Application. (Accession No. ML110190113)
March 17, 2011	Letter to Allen B. S., FENOC: Request for Additional Information on the Reactor Vessel Surveillance Aging Management Program, Time-Limited Aging Analyses (TLAAs) for Neutron Embrittlement of the Reactor Vessel and Internals, and Other TLAAs for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML110680172)
March 18, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Section 2.2 & 2.3 (TAC No. ME4640). (Accession No. ML110700732)
March 18, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 1. (Accession No. ML110830025)
March 21, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Section 4.7 (TAC No. ME4640). (Accession No. ML11068A000)
March 23, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML110880058)
March 23, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640), Section 2.4. (Accession No. ML110880059)
March 30, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Section 2.1 (TAC No. ME4640). (Accession No. ML110820624)

Date	Subject
April 5, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Batch 1 (TAC No. ME4640). (Accession No. ML110820490)
April 15, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information on the Reactor Vessel Surveillance Aging Management Program and Time-Limited Aging Analyses for Neutron Embrittlement for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 2. (Accession No. ML11109A083)
April 15, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application, Sections 2.2 & 2.3 (TAC No. ME4640), License Renewal Application Amendment No. 3, and Revised License Renewal Application Boundary Drawings. (Accession No. ML11110A088)
April 19, 2011	Letter to Allen B. S., FENOC: Scoping and Screening Audit Report Regarding the Davis-Besse Nuclear Power Station License Renewal Application. (Accession No. ML111050091)
April 20, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis Bessie Nuclear Power Station—Batch 2 (TAC No. ME4640). (Accession No. ML110980718)
April 20, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640), and License Renewal Application Amendment No. 4. (Accession No. ML11112A078)
April 29, 2011	Letter from Byrd K. W., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application, Section 2.1 (TAC No. ME4640), License Renewal Application Amendment No. 5, and Revised License Renewal Application Boundary Drawings. (Accession No. ML11126A016)
May 2, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Batch 3 (TAC No. ME4640). (Accession No. ML111170204)
May 5, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application, Batch 1 (TAC No. ME4640) and License Renewal Application Amendment No. 6. (Accession No. ML11131A073)
May 19, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station—Operating Experience (TAC No. ME4640). (Accession No. ML11132A203)
May 24, 2011	Letter from Byrd K. W., FENOC: Reply to Requests for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1. License Renewal Application, Batch 2 and Batch 1 (TAC No. ME4640), and License Renewal Application Amendment No. 7. (Accession No. ML11151A090)
June 1, 2011	Letter to Allen B.S., FENOC: Audit Report Regarding the Davis-Besse Nuclear Power Station License Renewal Application. (Accession No. ML11122A014)
June 3, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application, Batch 3 (TAC No. ME4640), and License Renewal Application Amendment No. 8. (Accession No. ML11159A132)
June 17, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640), and License Renewal Application Amendment No. 9. (Accession No. ML11172A389)

Date	Subject
June 20, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11167A171)
June 24, 2011	Letter from Byrd K. W., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Batch 4 (TAC No. ME4640), and License Renewal Application Amendment No. 11. (Accession No. ML11180A060)
June 24, 2011	Letter from Byrd K. W., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4613) Environmental Report Severe Accident Mitigation Alternatives Analysis and License Renewal Application Amendment No. 10. (Accession No. ML11180A233)
June 27, 2011	Letter to Allen B., FENOC: Davis-Besse Nuclear Power Station NRC License Renewal Scoping, Screening, and Aging management Inspection Report 05000346/2011010 (Accession No. ML11179A134)
July 11, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11174A191)
July 12, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11189A043)
July 21, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11195A020)
July 21, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11196A127)
July 22, 2011	Letter from Allen B. S., FENOC: Reply to Requests for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1. License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 12. (Accession No. ML11208C274)
July 27, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11203A080)
August 11, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11216A236)
August 17, 2011	Letter from Byrd K. W., FENOC: Reply to Request for Additional Information for the Review of License Renewal Application and License Renewal Application Amendment No. 13. (Accession No. ML11231A966)
August 26, 2011	Letter from Byrd K. W., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640), and License Renewal Application Amendment No. 14. (Accession No. ML11242A166)
September 9, 2011	Summary of Telephone Conference Call Held on June 7, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11242A007)
September 12, 2011	Summary of Telephone Conference Call Held on August 4, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11242A003)
September 16, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 15. (Accession No. ML11264A059)

Date	Subject
September 22, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11256A149)
September 30, 2011	Letter from Byrd K. W., FENOC: License Renewal Application Amendment No. 18 - Annual Update (TAC No. ME4640) (Accession No. ML11276A078)
October 7, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). License Renewal Application Amendment No. 19, and Revised License Renewal Application Boundary Drawings. (Accession No. ML11285A064)
October 7, 2011	Letter to Allen B., FENOC: Davis-Besse Nuclear Power Station NRC License Renewal Aging Management Follow-up Inspection Report 05000346/2011012. (Accession No. ML11284A242)
October 11, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML11271A147)
October 14, 2011	Congressional Correspondence—Letter from Markey E. J. to Jaczko G. B., NRC: Safe Operation of the Davis-Besse Nuclear Power Plant. (Accession No. ML11292A005)
October 21, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 20. (Accession No. ML11298A097)
October 31, 2011	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 21. (Accession No. ML11306A066)
October 31, 2011	Letter to Allen B. S., FENOC: Schedule Revision for the Environmental and Safety Review of the Davis-Besse Nuclear Power Station, Unit 1, License Renewal Application (TAC No. ME4613). (Accession No. ML11256A164)
November 8, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal Application. (Accession No. ML11306A141)
November 21, 2011	Congressional Correspondence—Letter from Kucinich D. J. to Jaczko G. B., NRC: Cracks in the Concrete Wall of the Shield Building of the Davis-Besse Power Plant. (Accession No. ML11332A094)
November 22, 2011	Summary of Telephone Conference Call Held on October 26, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11308A697)
November 23, 2011	Letter from Allen B. S., FENOC: Reply to Requests for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640), License Renewal Application Amendment No. 22, and Revised License Renewal Application Boundary Drawings. (Accession No. ML11335A223)
December 2, 2011	Summary of Telephone Conference Call Held on September 29, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11327A008)
December 2, 2011	Summary of Telephone Conference Call Held on July 27, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC. No. ME4640). (Accession No. ML11327A079)

Date	Subject
December 2, 2011	Summary of Telephone Conference Call Held on July 27, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11327A087)
December 2, 2011	Letter to Allen B.S., FENOC: Davis-Besse Confirmatory Action Letter 3-11-001. (Accession No. ML11336A355)
December 2, 2011	Meeting Notice: December 15, 2011, Notice of Public Meeting with First Energy Nuclear Operating Company to Discuss Their Technical Analysis Regarding Cracking Identified in the Davis-Besse Shield Building. (Accession No. ML113360416)
December 7, 2011	Letter from Allen B. S., FENOC: Reply to Request for Supplemental Information for the Review of the License Renewal Application (TAC No. ME4640). (Accession No. ML11342A100)
December 12, 2011	Congressional Correspondence—Letter to Kucinich D.J., U.S. House of Representatives: December 12, 2011, Letter to Honorable Dennis Kucinich Providing Documents that First Energy Nuclear Operating Company Provided to the NRC. (Accession No. ML11347A341)
December 13, 2011	Summary of Telephone Conference Call Held on November 22, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11339A086)
December 14, 2011	Summary of Telephone Conference Call Held on June 15, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11341A118)
December 21, 2011	Summary of Telephone Conference Call Held on November 1, 2011 Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11348A021)
December 22, 2011	Meeting Notice: January 5, 2012, Notice of Public Meeting with First Energy Nuclear Operating Company to Discuss Present the Results of its Evaluation of Shield Building Cracking and for the NRC to Present the Results of its Independent Assessment of that Evaluation." (Accession No. ML113560164)
December 27, 2011	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML11333A396)
December 27, 2011	Letter to Allen B. S., FENOC: Schedule Revision for the Safety Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML11353A015)
December 29, 2011	Summary of Telephone Conference Call Held on December 8, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning RAIs Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11355A095)
December 29, 2011	Press Release-III-11-037: NRC to Hold Meeting With FirstEnergy to Discuss Davis-Besse Shield Building Cracks. (Accession No. ML113630420)
January 13, 2012	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 23. (Accession No. ML12018A338)
January 19, 2012	Summary of Telephone Conference Call Held on November 14, 2011,Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning

Date	Subject
	Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11364A017)
January 23, 2012	Summary of Telephone Conference Call Held on June 29, 2011, Between the U.S. Nuclear regulatory Commission and First Energy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11363A167)
January 23, 2012	Summary of Telephone Conference Call held on December 12, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11363A171)
January 23, 2012	Summary of Telephone Conference Call Held on November 9, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12018A165)
January 30, 2012	Summary of Telephone Conference Call Held on August 22, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML11363A174)
January 31, 2012	Letter to Allen B. S., FENOC: Schedule Revision for the Environmental Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4613). (Accession No. ML12032A131)
February 1, 2012	Summary of Telephone Conference Call Held on June 28, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12018A022)
February 3, 2012	Summary of Telephone Conference Call Held on June 30, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12018A046)
February 9, 2012	Summary of Telephone Conference Call Held on June 16, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12018A146)
February 16, 2012	Summary Of Telephone Conference Call Held on January 24, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12045A016)
February 21, 2012	Summary of Telephone Conference Call Held on October 31, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Request for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12024A276)
February 22, 2012	Summary of Telephone Conference Call Held on September 7, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12025A047)
February 22, 2012	Summary of Telephone Conference Call Held on October 5, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12038A197)
February 24, 2012	Summary Of Telephone Conference Call Held On September 16, 2011, Between The U.S.

Date	Subject
	Nuclear Regulatory Commission And Firstenergy Nuclear Operating Company Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12039A013)
February 27, 2012	Summary of Telephone Conference Call Held on July 15, 2011, Between The U.S. Nuclear Regulatory Commission And FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining To The Davis-Besse Nuclear Power Station, License Renewal Application (TAC No. ME4640). (Accession No. ML12052A171)
February 27, 2012	Summary of Telephone Conference Call Held on August 2, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12033A060)
February 28, 2012	Summary of Telephone Conference Call Held on August 29, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests for Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12052A285)
March 2, 2012	Summary of Telephone Conference Call Held on July 13, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12031A183)
March 9, 2012	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12094A383)
April 2, 2012	Summary of Telephone Conference Call Held on July 12, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12061A258)
April 2, 2012	Summary of Telephone Conference Call Held on February 9, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12059A078)
April 5, 2012	Letter from Imlay D. M., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12097A520)
May 15, 2012	Summary of Telephone Conference Call Held on July 19, 2011, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12052A258)
May 25, 2012	Letter from Allen B. S., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12151A120)
May 25, 2012	Letter from Allen B. S., FENOC: Correction of Typographical Error in Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12151A119)
May 31, 2012	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal (TAC No. ME4640). (Accession No. ML12144A038)
June 12, 2012	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal (TAC No. ME4640). (Accession No. ML12160A016)

Date	Subject
June 14, 2012	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12167A369)
June 22, 2012	Summary of Telephone Conference Call Held on April 26, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No.ML12157A238)
June 22, 2012	Summary of Telephone Conference Call Held on April 17, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12157A231)
July 5, 2012	Letter from Allen B. S., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12191A037)
July 9, 2012	Summary of Telephone Conference Call Held on June 21, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12185A020)
July 11, 2012	Letter to Allen B. S., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal (TAC No. ME4640). (Accession No. ML12191A192)
July 11, 2012	Letter from Allen B. S., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12198A019)
July 26, 2012	Letter to Allen B. S., FENOC: Supplemental Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal (TAC No. ME4640). (Accession No. ML12201B519)
August 16, 2012	Letter from Imlay D. M., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12230A221)
August 16, 2012	Letter from Imlay D. M., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12230A220)
August 24, 2012	Letter from Allen B. S., FENOC: Reply to Supplemental Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12240A219)
September 7, 2012	Letter from Allen B. S., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12254A953)
October 26, 2012	Letter to Lieb R. A., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station (TAC No. ME4640). (Accession No. ML12292A627)
November 2, 2012	Letter from Lieb R. A., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML12311A024)
November 8, 2012	Summary of Telephone Conference Call Held on August 1, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML12299A396)

Date	Subject
November 14, 2012	Letter to Lieb R. A., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal Application Related to High Strength Bolting (TAC No. ME4640). (Accession No. ML12318A246)
December 11, 2012	Letter from FENOC: Davis-Besse, Unit 1, Enclosure A to L-12-444, Calculation 32-9195423-000, "DB-1 EMA of RPV Inlet & Outlet Nozzle-to-Shell Welds for 60 Years - Non-Proprietary." (Accession No. ML13009A374)
December 12, 2012	Letter from FENOC: Davis-Besse, Unit 1, Enclosure B to L-12-444, Calculation No. 32-9195651-000, "Equivalent Margins Assessment of Davis-Besse Transition Welds for 52 EFPY - Non-Proprietary." (Accession No. ML13009A375)
January 4, 2013	Letter to Lieb R. A., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal Application Related to the Shield Building Monitoring Program (TAC No. ME4640). (Accession No. ML12355A184)
January 7, 2013	Letter from FENOC: Submittal of Contractor Equivalent Margins Assessments for Reactor Vessel Welds (Nonproprietary Versions) (TAC No. ME4640). (Accession No. ML13009A373)
January 7, 2013	Letter from Lieb R. A., FENOC: Davis-Besse Nuclear Power Station, Unit 1, Notification of Closure of Commitments Related to the Review of the License Renewal Application (TAC No. ME4640). (Accession No. ML13008A330)
January 21, 2013	Letter from Imlay D. M., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13023A113)
January 29, 2013	Letter to Lieb R. A., FENOC: Schedule Revision for the Safety and Environmental Review of the Davis-Besse Nuclear Power Station License Renewal Application (TAC NO. ME4640). (Accession No. ML13011A301)
February 12, 2013	Letter from Imlay D. M., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13044A499)
February 14, 2013	Summary of Telephone Conference Call Held on October 23, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13025a027)
February 14, 2013	Letter to Lieb R. A., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal Application Related to the Bolting Integrity Program (TAC No. ME4640). (Accession No. ML13038A118)
February 28, 2013	Letter from Lieb R. A., FENOC: Revised Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13063A033)
March 14, 2013	Letter from Lieb R. A., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13077A391)
March 26, 2013	Letter to Lieb R. A., FENOC: Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13051A056)
March 26, 2013	Summary of Telephone Conference Call Held on January 16, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13051A068)
March 26, 2013	Summary of Telephone Conference Call Held on January 23, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning

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April 19, 2013	Letter from Lieb R. A., FENOC: Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13114A254)
May 17, 2013	Letter from Lieb R. A., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. MLML13141A271)
May 21, 2013	Letter from Lieb R. A., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13144A079)
June 3, 2013	Letter from Lieb R. A., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13156A388)
June 4, 2013	Letter from Imlay D. M., FENOC: Supplemental Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13158A302)
July 2, 2013	Summary of Telephone Conference Call Held on May 21, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13142A512)
July 9, 2013	Summary of Telephone Conference Call Held on , 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13149a288)
July 12, 2013	Summary of Telephone Conference Call Held on May 2, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13149A286)
July 12, 2013	Summary of Telephone Conference Call Held on April 11, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13182A443)
July 17, 2013	Summary of Telephone Conference Call Held on October 16, 2012, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13182A408)
July 17, 2013	Summary of Telephone Conference Call Held on May 28, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13197A257)
July 19, 2013	Summary of Telephone Conference Call Held on April 24, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning Requests For Additional Information Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13196A460)
July 23, 2013	Letter from Lieb R. A., FENOC: Notification of Completion of a License Renewal Commitment Related to the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640). (Accession No. ML13206A382)
July 31, 2013	Letter to Lieb R. A., FENOC: Schedule Revision for the Environmental and Safety Review of

Date	Subject
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August 29, 2013	Summary of Telephone Conference Call Held on August 22, 2013, Between the U.S. Nuclear Regulatory Commission and FirstEnergy Nuclear Operating Company, Concerning License Conditions Pertaining to the Davis-Besse Nuclear Power Station License Renewal Application (TAC No. ME4640). (Accession No. ML13240A070)

APPENDIX C

Principal Contributors

This appendix lists the principal contributors for the development of this safety evaluation report (SER) and their areas of responsibility.

Name	Responsibility
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Collins, J.	Reviewer—Materials
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Davidson, E.	Reviewer—Balance of Plant
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Diaz-Sanabria, Y.	Management Oversight
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Raval, J.	Reviewer—Mechanical
Razzaque, M.	Reviewer—Mechanical
Rhow, S.	Reviewer—Electrical
Rogers, B.	Reviewer—Scoping & Screening Methodology
Rosenberg, S.	Management Oversight
Ruland, W.	Management Oversight
Sahay, P.	Reviewer—Electrical
Sheikh, A.	Reviewer—Structural
Sheng, S.	Reviewer—Mechanical
Smith, E.	Reviewer—Scoping & Screening Methodology
Smith, W.	Reviewer—Mechanical
Sun, R.	Reviewer—Mechanical
Sydnor, C.	Reviewer—Mechanical
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Argonne National Laboratory	Technical Review
Center for Nuclear Regulatory Analysis	Technical Review
Oak Ridge National Laboratories	Technical Review
Ian, Evan, & Alexander Corporation	SER Support

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 Davis-Besse Nuclear Power Station (Davis-Besse), Docket Number 50-346.

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